KHULNA UNIVERSITY

Learn, Lead and Live

OBE OUTCOME BASED EDUCATION

Undergraduate Curriculum

Agrotechnology Discipline

Life Science School

2021-22

and onwards

OUTCOME-BASED CURRICULUM

BACHELOR OF SCIENCE IN AGRICULTURE (HONOURS)

Agrotechnology Discipline
Khulna University
August 2022

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01 Title of the Academic Program

Bachelor of Science in Agriculture (Honours)

Program Overview

Degree	Bachelor of Science in Agriculture (Honours)
Abbreviated form of the Degree	B. Sc. Ag (Hons.)
Discipline/Program Offering Entity (POE)	Agrotechnology Discipline
School	Life Science School
Awarding Institution	Khulna University
Location	Khulna 9208, Bangladesh
Bangladesh National Qualifications Framework (BNQF) Level	7
International Standard Classification of Education (ISCED) Code	0811
Mode of Study	Full Time
Language of Study	English
Applicable Session	2021-22 and onwards

02 Name of the University

Khulna University

Learn, Lead and Live

Learn: Students will enjoy unhindered learning facilities at KU;

Lead: Through proper learning they will emerge as global leaders;

Live: While learning, leading & serving they will enjoy self-living, will make the world safe & livable for others too.

03 Vision of the University

Creation of global leaders who will contribute to make knowledge-based just society through accelerating inclusive and transformative growth of Bangladesh and the world. The university aims to achieve this vision through scholarly enquiry and contribution to the global knowledge pool.

04 Mission of the University

University Mission & Details

UM1	Explore human potential to the fullest extent and produce self-motivated, aspiring leaders to work for the betterment of the humankind based on wisdom, freethinking, creativity and unhindered intellectual exercises.
UM2	Ensure a transformative educational experience that enables creative learning, entrepreneurship and inquisitiveness among the students.
UM3	Create an inclusive research environment that enables graduates to make demonstrable economic and social impacts through translating knowledge and innovation into practice driven by moral values and professional ethics.

UM = University Mission

05 Name of the Discipline/Program Offering Entity (POE)

Agrotechnology Discipline

06 Vision of the Discipline/POE

Facilitation of advanced agricultural education in achieving excellence and leadership in teaching, research and community services to ensure food security and safety.

07 Mission of the Discipline/POE

Discipline Mission & Details

M1	To provide education using an advanced outcome-based curriculum by blending fundamental, social, personal and thinking skills.
M2	To provide students with educational and research experience in various agricultural branches enhancing their talents in innovation, self-learning, and career competitiveness.
M3	To create a congenial teaching-learning environment to produce socially and ethically responsible graduates and entrepreneurs.
M4	To contribute in trans-disciplinary scientific innovation and progress for sustainable socio-economic enhancement.
M5	To act as a knowledge sharing platform for conducting collaborative research, technology transfer and community services.
M6	To address national and international agricultural issues through cutting edge and innovative research.

M = Mission of the Discipline/POE

08 Objectives of the Discipline/POE

Discipline Objectives & Details	
01	To provide advanced knowledge on sustainable agricultural production and management.
02	To develop technologies for profitable crop and livestock production.
03	To equip the students with modern crop protection and post-harvest management.
04	To enrich the students with proper knowledge of SAP (Smart Agricultural Practices) to work in diverse environment.
05	To broaden their knowledge on integrated farming and farm mechanization.
06	To equip students for application of ICT in agriculture.
07	To make the students ready for technology transfer.
08	To develop positive attitude of students towards community services.
09	To enable the students to collect, characterize and evaluate the germplasms for variety development and improvement.
010	To develop committed graduates to profession, community, society and country.

O = Objective of the Discipline/POE

09 Name of the Degree

Bachelor of Science in Agriculture (Honours)

10 Description of the Program

Agrotechnology Discipline started as one of the seven disciplines of Life Science School in 1996 with a mission to produce competent and skilled graduates in agriculture and with a vision to strengthen human resources and propel the development of the Agriculture in Bangladesh. The economy of Bangladesh is largely dependent on agriculture that includes 42% of her population in the farming sector. However, the farmers often fail to optimize their harvest from the farm due to lack of knowledge on modern agriculture. Agrotechnology Discipline is mandated to produce skilled workforce with advanced knowledge in agriculture. The curriculum of the program is multidisciplinary which covers courses from crop science, farm machinery, animal science, economics, ICT, statistics, sociology, chemistry, mathematics, GIS, spreadsheet analysis, computer studies, and so forth. The Discipline is striving continuously to ensure quality education for students. It is producing successfully at least 40 skilled agriculturists every year. The students are conducting researches on different local and national issues of agriculture funded by USDA, ACIAR, KGF, BARC, KU Research Cell, Ministry of Education, Ministry of Science and Technology, and UGC under the supervision of teachers and publishing articles in national and international journals. They are also developing technologies, collecting and evaluating germplasms of various crops that are going to be released soon under the guidance of expert faculties. Moreover, they are working on modern technologies like biotechnology, tissue culture, genetic engineering, protected agriculture, heat stress mitigation, irrigation management, IPM, biological control of pests etc. The program also arranges seminars, trainings, and workshops for stakeholders with the active participation of students.

11 Graduate Attributes

	Graduate Attributes	Domain
GA1	Graduates will ● develop an in-depth knowledge of agriculture and apply it to solve complex and/or concurrent agricultural problems. ● demonstrate a better understanding of the global agricultural environment. ● apply ICT to carry out complex tasks and generate solutions. ● use cognitive and critical thinking skills to identify, analyze and evaluate agricultural issues, theories and concepts to construct solutions. ● deal with and solve real-world problems in agricultural science and management.	Fundamental
GA2	Graduates will ● utilize cognitive and communication skills, tools and digital technologies to communicate appropriately and persuasively with a range of stakeholders both in Bangla and English. ● diffuse agricultural innovations and information to the end users	Social
GA3	Graduates will ● be creative and innovative with critical judgment. ● be an emotionally intelligent manager encouraging intellectual autonomy to meet management challenges	Thinking
GA4	Graduates will ● gain confidence in their ability to critically analyze information relevant to the discipline. ● demonstrate the ability to identify, evaluate and implement personal learning strategies in pursuit of ongoing personal and professional development. ● develop the skills to work collectively in a team to define and achieve common goals. ● handle controversial situations with logical arguments in a professional forum. ● develop oral, written and presentation skills as per organizational patterns both in Bangla and English ● act ethically and be socially responsible ● integrate legal obligations and responsibilities ● function effectively as a member or leader of diverse teams as well as in multidisciplinary settings	Personal

GA = Graduate Attributes

12 Program Educational Objectives (PEOs)

	Program Educational Objectives	Domain
PEO1	Accommodate precious information of agrarian principles necessary for applications in agriculture.	Fundamental
PEO2	Perceive knowledge of recent trends in technology and solve problems of the stakeholders.	Fundamental
PEO3	Adopt hands-on experience and interpersonal skills to work both in local and global settings.	Social
PEO4	Possess innovative professionalism, realize their ethical duty and are patriotically dedicated to societal and national development.	Personal
PEO5	Occupy decision-making positions in private and public organizations both locally and internationally by the virtue of active learning and critical thinking.	Thinking

PEO = Program Educational Objective

13 Program Learning Outcomes (PLOs)

After successful completion of the degree, the learners will be able to:

A. Fundamental Skills	
PLO1	Demonstrate a substantial knowledge and understanding of the core aspects of Agriculture.
PLO2	Apply the theoretical insights and methods of inquiry from their field of study to other contexts.
PLO3	Investigate complex problems and develop creative solutions by using their insights from their own and other related fields of study.
PLO4	Develop different varieties of crops and characterize pests and pathogens as well as management and improvement of livestock and poultry.
PLO5	Evaluate various agricultural technologies for improved production.
B. Social Skills	
PLO6	Take part in independent learning using scholarly reviews and Secondary sources of information.
PLO7	Employ in activities to keep them up to date with developments in their field and enhance their own knowledge, understanding and skills.
PLO8	Demonstrate a high level of ethical and responsible behavior in academic, professional and community environments.
C. Thinking Skills	
PLO9	Use practical skills and inquisitiveness efficiently and effectively within the area of study.
PLO10	Analyze data critically, make judgments and propose solutions to problems.
D. Personal Skills	
PLO11	Communicate information, ideas, issues and solutions efficiently and effectively among the professionals, scientists, and farmers.
PLO12	Conduct research under the guidance of a supervisor.

PLO = Program Learning Outcome

14 Mapping Mission of the University with PEOs

PEOs \ Missions	UM1	UM2	UM3
PEO1	1	3	1
PEO2	3	2	2
PEO3	3	1	2
PEO4	2	2	3
PEO5	3	1	1

Level of association: 3=High, 2=Medium, 1=Low

15 Mapping PLOs with PEOs

Program Learning Outcomes (PLOs)		Program Educational Objectives (PEOs)				
		PEO1	PEO2	PEO3	PEO4	PEO5
Fundamental Domain	PLO1	●	●	●		
	PLO2		●			
	PLO3	●	●			●
	PLO4	●	●	●		
	PLO5	●	●		●	
Social Domain	PLO6	●	●			
	PLO7			●	●	
	PLO8				●	●
Thinking Domain	PLO9		●	●	●	
	PLO10				●	●
Personal Domain	PLO11				●	●
	PLO12	●		●	●	●

16 Mapping Courses with PLOs

Course Code and Course Title	Program Learning Outcomes (PLOs)											
	Fundamental Domain					Social Domain			Thinking Domain		Personal Domain	
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
First Year First Term												
0811 08 AT 1101: Fundamentals of Agronomy	●	●	●		●							
0811 08 AT 1102: Fundamentals of Agronomy Sessional and Fieldwork	●	●	●		●				●	●		
0811 08 AT 1103: Introductory Soil Science	●	●	●			●						
0811 08 AT 1104: Introductory Soil Science Sessional and Fieldwork	●	●	●		●	●				●		
0811 08 AT 1105: Agricultural Botany	●	●	●						●			
0811 08 AT 1106: Agricultural Botany Sessional and Fieldwork	●	●		●	●							
0314 08 Soc 1155: Sociology	●	●	●					●	●	●	●	
0531 08 Chem 1159: Chemistry		●	●						●			
0531 08 Chem 1160: Chemistry Sessional			●						●			
0541 08 Math 1161: Mathematics	●	●	●									
First Year Second Term												
0811 08 AT 1201: Weed Management	●	●			●							
0811 08 AT 1202: Weed Management Sessional and Fieldwork	●	●	●		●						●	
0811 08 AT 1203: Fundamentals of Horticulture	●	●	●	●	●				●			
0811 08 AT 1204: Fundamentals of Horticulture Sessional and Fieldwork	●	●	●		●				●			
0811 08 AT 1205: Introductory Animal and Poultry Science	●	●		●						●		
0811 08 AT 1206: Introductory Animal and Poultry Science Sessional and Fieldwork	●	●							●	●		
0811 08 AT 1207: Introductory Entomology	●	●			●	●	●		●			
0811 08 AT 1208: Introductory Entomology Sessional and Fieldwork	●	●		●	●		●		●			
0512 08 AT 1209: Biochemistry			●						●			
05121 08 AT 1210: Biochemistry Sessional									●			●
0231 08 Eng 1251: Comprehension and Communication Skills in English	●	●				●	●					
0613 08 CSE 1260: Word Processing and Spreadsheet Analysis		●	●						●	●		

Course Code and Course Title	Program Learning Outcomes (PLOs)											
	Fundamental Domain					Social Domain			Thinking Domain		Personal Domain	
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Second Year First Term												
0811 08 AT 2101: Fundamentals of Plant Pathology	●	●	●									
0811 08 AT 2102: Fundamentals of Plant Pathology Sessional and Fieldwork	●	●	●	●					●			
0811 08 AT 2103: Plant Physiology	●	●	●								●	
0811 08 AT 2104: Plant Physiology Sessional and Fieldwork	●	●		●						●		●
0811 08 AT 2105: Agrometeorology and Environmental Impact	●	●	●	●							●	●
0811 08 AT 2106: Agrometeorology and Environmental Impact Sessional and Fieldwork	●	●	●		●		●	●	●		●	
0811 08 AT 2107: Ornamental Horticulture	●	●	●		●				●			
0811 08 AT 2108: Ornamental Horticulture Sessional and Fieldwork	●	●	●		●				●			
0811 08 AT 2109: Cattle and Poultry Farming	●	●		●					●	●		
0811 08 AT 2110: Cattle and Poultry Farming Sessional and Fieldwork	●			●				●	●	●		
0731 08 URP 2154: GIS Sessional–I	●	●	●				●					
0311 08 Econ 2155: Agricultural Economics	●		●			●	●					
0721 08 FT 2157: Food Technology	●	●	●		●				●	●	●	
0721 08 FT 2158: Food Technology Sessional and Fieldwork	●					●			●	●	●	
Second Year Second Term												
0811 08 AT 2201: Seed Technology	●	●	●		●		●		●		●	
0811 08 AT 2202: Seed Technology Sessional and Fieldwork	●	●			●		●	●	●		●	
0811 08 AT 2203: Soil Survey and Soil Physics	●	●	●				●				●	
0811 08 AT 2204: Soil Survey and Soil Physics Sessional and Fieldwork	●	●				●	●					
0811 08 AT 2205: Cytology, Genetics and Cytogenetics		●	●	●				●				
0811 08 AT 2206: Cytology, Genetics and Cytogenetics Sessional		●	●	●							●	●
0715 08 AT 2207: Agrimachinery and Farm Mechanization	●	●				●	●		●			
0715 08 AT 2208: Agrimachinery and Farm Mechanization Sessional and Fieldwork	●	●		●			●		●			
0811 08 AT 2209: Methods in Plant Pathology	●				●				●	●		
0811 08 AT 2211: Feeds, Fodder and Animal Nutrition	●	●		●	●				●	●		
0811 08 AT 2212: Feeds, Fodder and Animal Nutrition Sessional and Fieldwork									●	●		
0542 08 STAT 2253: Statistics	●	●	●						●	●		
0542 08 STAT 2254: Statistics Sessional and Fieldwork	●	●		●								
0613 08 CSE 2260: Database and Statistical Package Sessional	●	●	●			●	●					●

Course Code and Course Title	Program Learning Outcomes (PLOs)											
	Fundamental Domain					Social Domain			Thinking Domain		Personal Domain	
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Third Year First Term												
0811 08 AT 3101: Production Technology of Field Crops	●	●	●		●						●	
0811 08 AT 3102: Production Technology of Field Crops Sessional and Fieldwork	●	●	●		●				●	●	●	
0811 08 AT 3103: Agricultural Chemistry	●	●				●	●		●			
0811 08 AT 3104: Agricultural Chemistry Sessional and Fieldwork	●	●				●	●		●			
0811 08 AT 3105: Insect Physiology and Ecology	●	●				●	●		●			
0811 08 AT 3106: Insect Physiology and Ecology Sessional and Fieldwork	●	●		●			●		●			
0811 08 AT 3107: Production of Spices and Plantation Crops	●	●	●	●	●				●			
0811 08 AT 3108: Production of Spices and Plantation Crops Sessional and Fieldwork	●	●	●		●				●			
0811 08 AT 3109: Agroforestry and Social Forestry	●	●	●	●	●		●					
0811 08 AT 3110: Agroforestry and Social Forestry Sessional and Fieldwork		●		●	●				●			
0811 08 AT 3111: Irrigation and Water Management	●	●	●		●						●	
0811 08 AT 3112: Irrigation and Water Management Sessional and Fieldwork	●	●	●		●			●	●	●		
0511 08 AT 3113: Molecular Biology		●	●									
0511 08 AT 3114: Molecular Biology Sessional		●							●		●	●
0611 08 CSE 3160: Information Communication Technology in Agriculture Sessional and Fieldwork		●			●	●	●				●	

Course Code and Course Title	Program Learning Outcomes (PLOs)											
	Fundamental Domain					Social Domain			Thinking Domain		Personal Domain	
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Third Year Second Term												
0811 08 AT 3201: Principles of Plant Pathology and Diseases of Field Crops	●				●				●	●		
0811 08 AT 3202: Principles of Plant Pathology and Diseases of Field Crops Sessional and Fieldwork	●	●			●		●	●	●			
0811 08 AT 3203: Crop Ecology	●	●	●				●				●	
0811 08 AT 3204: Crop Ecology Sessional and Fieldwork	●	●			●						●	
0811 08 AT 3205: Fundamentals of Extension, Communication and Leadership	●	●							●		●	
0811 08 AT 3206: Fundamentals of Extension, Communication and Leadership Sessional and Fieldwork	●						●		●			
0811 08 AT 3207: Olericulture	●	●	●		●				●			
0811 08 AT 3208: Olericulture Sessional and Fieldwork	●	●	●		●				●			
0811 08 AT 3211: Horticulture and Forest Nursery Management	●	●	●		●			●	●			
0811 08 AT 3212: Horticulture and Forest Nursery Management Sessional and Fieldwork	●	●	●						●			
0521 08 AT 3213: Environmental Pollution and Crop Growth	●	●	●	●								
0731 08 URP 3254: GIS Sessional–II	●	●								●	●	
0588 08 RM 3255: Research Methodology	●	●	●	●	●					●		●
0588 08 RM 3256: Research Methodology Sessional and Fieldwork	●	●	●	●	●		●	●		●	●	●

Course Code and Course Title	Program Learning Outcomes (PLOs)											
	Fundamental Domain					Social Domain			Thinking Domain		Personal Domain	
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Fourth Year First Term												
0811 08 AT 4101: Plant Breeding	●	●	●		●				●			●
0811 08 AT 4102: Plant Breeding Sessional and Fieldwork	●	●	●		●		●		●	●		●
0811 08 AT 4103: Pomology	●	●	●		●				●			
0811 08 AT 4104: Pomology Sessional and Fieldwork	●	●	●		●				●			
0811 08 AT 4105: Diseases of Horticultural Crops and Seed Pathology	●		●		●				●	●		
0811 08 AT 4106: Diseases of Horticultural Crops and Seed Pathology Sessional and Fieldwork	●	●	●	●	●				●	●		
0811 08 AT 4107: Stresses in Agriculture and Disaster Management	●	●	●		●				●	●		
0511 08 AT 4111: Biorational and Molecular Pest Management	●	●				●	●		●			
0511 08 AT 4112: Biorational and Molecular Pest Management Sessional and Fieldwork	●	●		●			●		●			
0811 08 AT 4114: Thesis	●					●			●			●
0811 08 AT 4116: Project	●					●			●			●
0811 08 AT 4118: Internship	●					●			●			●
0321 08 MCJ 4151: Agricultural Journalism	●										●	
0111 08 IER 4154: Agricultural Study Tour and Field Visit	●	●	●		●		●		●		●	
0418 08 BA 4159: Agribusiness and Entrepreneurship			●		●	●	●					

Course Code and Course Title	Program Learning Outcomes (PLOs)											
	Fundamental Domain					Social Domain			Thinking Domain		Personal Domain	
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Fourth Year Second Term												
0811 08 AT 4201: Cropping System and Sustainable Agriculture	●	●	●	●	●							
0811 08 AT 4202: Cropping System and Sustainable Agriculture Sessional and Fieldwork	●	●	●						●	●		
0811 08 AT 4203: Soil Fertility Management	●	●	●		●	●						●
0811 08 AT 4204: Soil Fertility Management Sessional and Fieldwork	●	●	●			●			●		●	●
0811 08 AT 4205: Plant Biotechnology	●	●			●	●						
0811 08 AT 4206: Plant Biotechnology Sessional	●	●	●						●		●	●
0811 08 AT 4207: Organizational Management and Diffusion of Innovation	●						●	●	●	●	●	
0811 08 AT 4208: Extension Program Planning and Outreach Program Sessional and Fieldwork		●							●		●	
0811 08 AT 4209: Economic Entomology and Pest Management	●			●		●	●		●			
0811 08 AT 4210: Economic Entomology and Pest Management Sessional and Fieldwork	●			●			●		●			
0118 08 AT 4214: Central Viva Voce	●	●	●	●	●				●	●		
0721 08 AT 4251: Post Harvest Technology	●	●	●	●	●				●			
0721 08 AT 4252: Post Harvest Technology Sessional and Fieldwork	●	●	●	●	●				●			

17 Structure of the Curriculum

a)	Duration of the Program	04 Years	08 Terms
b)	Admission Requirements	The applicants having HSC or equivalent degree will be eligible for admission into this program. Other terms and conditions are set or revised periodically by the appropriate authority.	
c1)	Graduating Credits / Total Minimum Credit Requirement to Complete the Program	161	
c2)	Available Credits	214	
d)	Total Class Weeks in a Term*	14	
e)	Minimum CGPA Requirements for Graduation	2.50	
f)	Maximum Academic Years of Completion	07 Years	

*Term Duration

Teaching and Learning	Preparatory Leave	Term Final Examination	Term Break	Total
14 Weeks	2 Weeks	4 Weeks	2 Weeks	22 Weeks

g1) Area-wise Credit Distribution

Area	Course Type	Number of Courses	Credits	Total Credits
General Education (GED) Courses**	Theory	15	39	57
	Sessional	15	18	
Core/Compulsory Courses	Theory	33	94	126
	Sessional	32	32	
Optional/Elective Courses	Theory	6	15	19
	Sessional	4	4	
Capstone Courses***	Sessional	3	12	12
	Total	108	214	214

**26.64% from GED courses [Please note that GED courses should be at least 25%]
58.88% from Core/Compulsory Courses
8.88% from Optional/Elective Courses
5.60% from Capstone Courses

*** Thesis, project, internship etc. courses

g2) Category of Courses [*Optional/Elective courses; Numbers in the first bracket indicate the Credit of the Course]

Area	Course Type	Course Title	Credits
General Education (GED) Courses	Theory	01. Sociology (2) 02. Chemistry (3) 03. Mathematics (3) 04. Comprehension and Communication Skills in English (2) 05. Biochemistry (3) 06. Agricultural Economics (3) 07. Food Technology (3) 08. Agrimachenary and Farm Mechanization (2) 09. Statistics (2) 10. Research Methodology (2) 11. Environmental Pollutiion and Crop Growth (3)	39

Area	Course Type	Course Title	Credits
	Theory	12. Agribusiness & Entrepreneurship Development (2) 13. Biorational and Molecular Pest Management (3) 14. Agricultural Journalism (3) 15. Postharvest Technology (3)	
General Education (GED) Courses	Sessional	01. Chemistry Sessional (1) 02. Biochemistry Sessional (1) 03. Word Processing and Spreadsheet Analysis (1.5) 04. GIS Sessional–I (1.5) 05. Food Technology Sessional and Fieldwork (1) 06. Agrimachenary and Farm Mechanization Sessional and Fieldwork (1) 07. Statistics Sessional (1) 08. Database and Statistical Package Sessional (1.5) 09. Research Methodology Sessional and Fieldwork (1) 10. GIS Sessional–II (1.5) 11. Information Communication Technology in Agriculture Sessional and Fieldwork (2) 12. Biorational and Molecular Pest Management Sessional and Fieldwork (1) 13. Agricultural Study Tour and Field Visit (1) 14. Postharvest Technology Sessional and Fieldwork (1) 15. Central Viva-Voce (1)	18
Core/ Compulsory Courses	Theory	01. Fundamentals of Agronomy (3) 02. Introductory Soil Science (3) 03. Agricultural Botany (3) 04. Weed Management (2) 05. Fundamentals of Horticulture (2) 06. Introductory Animal and Poultry Science (2) 07. Introductory Entomology (3) 08. Fundamentals of Plant Pathology (3) 09. Plant Physiology (3) 10. Agrometeorology and Environmental Impact (3) 11. Ornamental Horticulture (3) 12. Cattle and Poultry Farming (2) 13. Seed Technology (3) 14. Soil Survey and Soil Physics (3) 15. Cytology, Genetics and Cytogenetics (3) 16. Production Technology of Field Crops (3) 17. Agricultural Chemistry (3) 18. Insect Physiology and Ecology (3) 19. Production of Spices and Plantation Crops (3) 20. Agroforestry and Social Forestry (2) 21. Principles of Plant Pathology and Diseases of Field Crops (3) 22. Crop Ecology (3) 23. Fundamentals of Extension, Communication and Leadership (3) 24. Olericulture (3) 25. Plant Breeding (3) 26. Pomology (3) 27. Diseases of Horticultural Crops and Seed Pathology (3) 28. Stresses in Agriculture and Disaster Management (3) 29. Cropping System and Sustainable Agriculture (3) 30. Soil Fertility Management (3) 31. Plant Biotechnology (3) 32. Organizational Management and Diffusion of Innovation (3) 33. Economic Entomology and Pest Management (3)	94

Area	Course Type	Course Title	Credits
Core/ Compulsory Courses	Sessional	01. Fundamentals of Agronomy Sessional and Fieldwork (1) 02. Introductory Soil Science Sessional and Fieldwork (1) 03. Agricultural Botany Sessional and Fieldwork (1) 04. Weed Management Sessional and Fieldwork (1) 05. Fundamentals of Horticulture Sessional and Fieldwork (1) 06. Introductory Animal and Poultry Science Sessional and Fieldwork (1) 07. Introductory Entomology Sessional and Fieldwork (1) 08. Fundamentals of Plant Pathology Sessional and Fieldwork (1) 09. Plant Physiology Sessional and Fieldwork (1) 10. Agrometeorology and Environmental Impact Sessional and Fieldwork (1) 11. Ornamental Horticulture Sessional and Fieldwork (1) 12. Cattle and Poultry Farming Sessional and Fieldwork (1) 13. Seed Technology Sessional and Fieldwork (1) 14. Soil Survey and Soil Physics Sessional and Fieldwork (1) 15. Cytology, Genetics and Cytogenetics Sessional (1) 16. Production Technology of Field Crops Sessional and Fieldwork (1) 17. Agricultural Chemistry Sessional and Fieldwork (1) 18. Insect Physiology and Ecology Sessional and Fieldwork (1) 19. Production of Spices and Plantation Crops Sessional and Fieldwork (1) 20. Agroforestry and Social Forestry Sessional and Fieldwork (1) 21. Principles of Plant Pathology and Diseases of Field Crops Sessional and Fieldwork (1) 22. Crop Ecology Sessional and Fieldwork (1) 23. Fundamentals of Extension, Communication and Leadership Sessional and Fieldwork (1) 24. Olericulture Sessional and Fieldwork (1) 25. Plant Breeding Sessional and Fieldwork (1) 26. Pomology Sessional and Fieldwork (1) 27. Diseases of Horticultural Crops and Seed Pathology Sessional and Fieldwork (1) 28. Cropping System and Sustainable Agriculture Sessional and Fieldwork (1) 29. Soil Fertility Management Sessional and Fieldwork (1) 30. Plant Biotechnology Sessional (1) 31. Extension Program Planning and Outreach Program Sessional and Fieldwork (1) 32. Economic Entomology and Pest Management Sessional and Fieldwork (1)	32
Optional/ Elective Courses	Theory	01. Methods in Plant Pathology (2) 02. Feeds, Fodder and Animal Nutrition (2) 03. Horticulture and Forest Nursery Management (2) 04. Irrigation and Water Management (3) 05. Molecular Biology (3) 06. Environmental Pollution and Crop Growth (3)	15
	Sessional	01. Feeds, Fodder and Animal Nutrition Sessional and Fieldwork (1) 02. Irrigation and Water Management Sessional and Fieldwork (1) 03. Molecular Biology Sessional (1) 04. Horticulture and Forest Nursery Management Sessional and Fieldwork (1)	4
Capstone Courses	Sessional	01. Thesis (6) 02. Project (3) 03. Internship (3)	12
		Total	214

18 Year/Term-wise Distribution of Courses

Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
First Year First Term						
0811 08 AT 1101	Fundamentals of Agronomy	Core	3	-	3	None
0811 08 AT 1102	Fundamentals of Agronomy Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 1103	Introductory Soil Science	Core	3	-	3	None
0811 08 AT 1104	Introductory Soil Science Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 1105	Agricultural Botany	Core	3	-	3	None
0811 08 AT 1106	Agricultural Botany Sessional and Fieldwork	Core	-	1.5	1	None
0314 16 Soc 1155	Sociology	Core	2	-	2	None
0531 08 Chem 1159	Chemistry	Core	3	-	3	None
0531 08 Chem 1160	Chemistry Sessional	Core	-	1.5	1	None
0541 08 Math 1161	Mathematics	Optional	3	-	3	None
Total	Core Courses: 09, Optional Courses: 01 Theory Courses: 06, Sessional Courses: 04		17.0	6.0	21.0	
			23.0			
First Year Second Term						
0811 08 AT 1201	Weed Management	Core	2	-	2	None
0811 08 AT 1202	Weed Management Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 1203	Fundamentals of Horticulture	Core	2	-	2	None
0811 08 AT 1204	Fundamentals of Horticulture Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 1205	Introductory Animal and Poultry Science	Core	2	-	2	None
0811 08 AT 1206	Introductory Animal and Poultry Science Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 1207	Introductory Entomology	Core	3	-	3	None
0811 08 AT 1208	Introductory Entomology Sessional and Fieldwork	Core	-	1.5	1	None
0512 08 AT 1209	Biochemistry	Core	3	-	3	None
0512 08 AT 1210	Biochemistry Sessional	Core	-	1.5	1	None
0231 08 Eng 1251	Comprehension and Communication Skills in English	Core	2	-	2	None
0613 08 CSE 1260	Word Processing and Spreadsheet Analysis	Optional	-	2.25	1.5	None
Total	Core Courses: 11, Optional Courses: 01 Theory Courses: 06, Sessional Courses: 06		14	9.75	20.5	
			23.75			

Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
Second Year First Term						
0811 08 AT 2101	Fundamentals of Plant Pathology	Core	3	-	3	None
0811 08 AT 2102	Fundamentals of Plant Pathology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 2103	Plant Physiology	Core	3	-	3	None
0811 08 AT 2104	Plant Physiology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 2105	Agrometeorology and Environmental Impact	Core	3	-	3	None
0811 08 AT 2106	Agrometeorology and Environmental Impact Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 2107	Ornamental Horticulture	Core	3	-	3	None
0811 08 AT 2108	Ornamental Horticulture Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 2109	Cattle and Poultry Farming	Core	2	-	2	None
0811 08 AT 2110	Cattle and Poultry Farming Sessional and Fieldwork	Core	-	1.5	1	None
0731 08 URP 2154	GIS Sessional–I	Optional	-	2.25	1.5	None
0311 08 Econ 2155	Agricultural Economics	Core	3	-	3	None
0721 08 FT 2157	Food Technology	Optional	3	-	3	None
0721 08 FT 2158	Food Technology Sessional and Fieldwork	Optional	-	1.5	1	None
Total	Core Courses: 11, Optional Courses: 03 Theory Courses: 07, Sessional Courses: 07		20	11.25	27.5	
			31. 25			
Second Year Second Term						
0811 08 AT 2201	Seed Technology	Core	3	-	3	None
0811 08 AT 2202	Seed Technology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 2203	Soil Survey and Soil Physics	Core	3	-	3	None
0811 08 AT 2204	Soil Survey and Soil Physics Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 2205	Cytology, Genetics and Cytogenetics	Core	3	-	3	None
0811 08 AT 2206	Cytology, Genetics and Cytogenetics Sessional	Core	-	1.5	1	None
0715 08 AT 2207	Agrimachenary and Farm Mechanization	Optional	2	-	2	None
0715 08 AT 2208	Agrimachenary and Farm Mechanization Sessional and Fieldwork	Optional	-	1.5	1	None
0811 08 AT 2209	Methods in Plant Pathology	Optional	2	-	2	None
0811 08 AT 2211	Feeds, Fodder and Animal Nutrition	Optional	2	-	2	None
0811 08 AT 2212	Feeds, Fodder and Animal Nutrition Sessional and Fieldwork	Optional	-	1.5	1	None
0542 08 STAT 2253	Statistics	Core	2	-	2	None
0542 08 STAT 2254	Statistics Sessional and Fieldwork	Core	-	1.5	1	None
0613 08 CSE 2260	Database and Statistical Package Sessional	Optional	-	2.25	1.5	None
Total	Core Courses: 08, Optional Courses: 06 Theory Courses: 07, Sessional Courses: 07		17	11.25	24.5	
			28.25			

Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
Third Year First Term						
0811 08 AT 3101	Production Technology of Field Crops	Core	3	-	3	None
0811 08 AT 3102	Production Technology of Field Crops Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3103	Agricultural Chemistry	Core	3	-	3	None
0811 08 AT 3104	Agricultural Chemistry Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3105	Insect Physiology and Ecology	Core	3	-	3	None
0811 08 AT 3106	Insect Physiology and Ecology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3107	Production of Spices and Plantation Crops	Core	3	-	3	None
0811 08 AT 3108	Production of Spices and Plantation Crops Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3109	Agroforestry and Social Forestry	Core	2	-	2	None
0811 08 AT 3110	Agroforestry and Social Forestry Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3111	Irrigation and Water Management	Optional	3	-	3	None
0811 08 AT 3112	Irrigation and Water Management Sessional and Fieldwork	Optional	-	1.5	1	None
0511 08 AT 3113	Molecular Biology	Optional	3	-	3	None
0511 08 AT 3114	Molecular Biology Sessional	Optional	-	1.5	1	None
0611 08 CSE 3160	Information Communication Technology in Agriculture Sessional and Fieldwork	Optional	-	3.0	2	None
Total	Core Courses: 10, Optional Courses: 05 Theory Courses: 07, Sessional Courses: 08		20	13.5	29.0	
			33.5			
Third Year Second Term						
0811 08 AT 3201	Principles of Plant Pathology and Diseases of Field Crops	Core	3	-	3	None
0811 08 AT 3202	Principles of Plant Pathology and Diseases of Field Crops Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3203	Crop Ecology	Core	3	-	3	None
0811 08 AT 3204	Crop Ecology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3205	Fundamentals of Extension, Communication and Leadership	Core	3	-	3	None
0811 08 AT 3206	Fundamentals of Extension, Communication and Leadership Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3207	Olericulture	Core	3	-	3	None
0811 08 AT 3208	Olericulture Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 3211	Horticulture and Forest Nursery Management	Optional	2	-	2	None
0811 08 AT 3212	Horticulture and Forest Nursery Management Sessional and Fieldwork	Optional	-	1.5	1	None None
0521 08 AT 3213	Environmental Pollution and Crop Growth	Optional	3	-	3	None
0731 08 URP 3254	GIS Sessional–II	Optional	-	2.25	1.5	
0588 08 RM 3255	Research Methodology	Core	2	-	2	None
0588 08 RM 3256	Research Methodology Sessional and Fieldwork	Core	-	1.5	1	None
Total	Core Courses: 10, Optional Courses: 04 Theory Courses: 07, Sessional Courses: 07		19	11.25	26.5	
			30.25			

Course Code	Course Title	Course Status	Contact Hours/Week		Credits	Prerequisites
			Theory	Sessional		
Fourth Year First Term						
0811 08 AT 4101	Plant Breeding	Core	3	-	3	None
0811 08 AT 4102	Plant Breeding Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 4103	Pomology	Core	3	-	3	None
0811 08 AT 4104	Pomology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 4105	Diseases of Horticultural Crops and Seed Pathology	Core	3	-	3	None
0811 08 AT 4106	Diseases of Horticultural Crops and Seed Pathology Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 4107	Stresses in Agriculture and Disaster Management	Core	3	-	3	None
0418 08 BA 4159	Agribusiness and Entrepreneurship	Optional	2	-	2	None
0511 08 AT 4111	Biorational and Molecular Pest Management	Optional	2	-	3	
0511 08 AT 4112	Biorational and Molecular Pest Management Sessional and Fieldwork	Optional	-	1.5	1	
0811 08 AT 4114	Thesis	Core	-	9	6	
0811 08 AT 4116	Project	Core	-	4.5	3	
0811 08 AT 4118	Internship	Core	-	4.5	3	
*0321 08 MCJ 4151	Agricultural Journalism	Optional	3	-	3	None
0111 08 IER 4154	Agricultural Study Tour and Field Visit	Core	-	1.5	1	
Total	Core Courses: 11, Optional Courses: 04 Theory Courses: 07, Sessional Courses: 08		19	25.5	37	
			44.5			
Fourth Year Second Term						
0811 08 AT 4201	Cropping System and Sustainable Agriculture	Core	3	-	3	None
0811 08 AT 4202	Cropping System and Sustainable Agriculture Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 4203	Soil Fertility Management	Core	3	-	3	None
0811 08 AT 4204	Soil Fertility Management Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 4205	Plant Biotechnology	Core	3	-	3	None
0811 08 AT 4206	Plant Biotechnology Sessional	Core	-	1.5	1	None
0811 08 AT 4207	Organizational Management and Diffusion of Innovation	Core	3	-	3	None
0811 08 AT 4208	Extension Program planning and Outreach Program Sessional and Fieldwork	Core	-	1.5	1	None
0811 08 AT 4209	Economic Entomology and Pest Management	Core	3	-	3	None
0811 08 AT 4210	Economic Entomology and Pest Management Sessional and Fieldwork	Core	-	1.5	1	None
0721 08 AT 4251	Post Harvest Technology	Optional	3	-	3	None
0721 08 AT 4252	Post Harvest Technology Sessional and Fieldwork	Optional	-	1.5	1	None
0118 08 AT 4214	Central Viva Voce	Core	-	1.5	1	None
Total	Core Courses: 11, Optional Courses: 02 Theory Courses: 06, Sessional Courses: 07		18	10.5	25	
			28.5			

N.B. 0811 08 AT 4114: Thesis; 0811 08 AT 4116: Project; 0811 08 AT 4118: Internship Registration in Term I and Defense in Term II.
Each student must complete any one capstone course from Thesis, Project and Internship

19 Course Description

First Year First Term			
Course Code: 0811 08 AT 1101		Year: First	Term: First
Course Title	Fundamentals of Agronomy		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This introductory course of agronomy contains fundamental concepts of agronomy and practices involved in crop production.		

	Course Contents	CLOs
	Section A	
1	Introduction: Concept, importance and scope of agriculture and agronomy; history of agriculture; chronology of Bangladesh agriculture; basic principles of agronomy; agricultural research institutes of Bangladesh.	2
2	Climate and crops: Definition of weather and climate; differences between weather and climate; weather elements and their role on the growth and development of crops; micro and macro climate.	1
3	Agricultural geography of Bangladesh: Location of Bangladesh in agricultural perspective; land topographic units and the crops grown therein; agroecological zones of Bangladesh; crops: concept and classification; cropping seasons and their characteristics, land utilization pattern.	2
4	Crop nutrition: Essential plant nutrient elements–their sources, forms of absorption, functions, hunger signs and toxic effects.	3
	Section B	CLOs
5	Land preparation: Definition, classification and objectives of tillage; influences of tillage on soil properties; classification of tillage implements; tillage operations and their objectives; minimum tillage.	4
6	Manures and fertilizers: Concept, classification, nutrients content; composting and green manuring; methods of application of manures and fertilizers and environment.	3
7	Planting methods: Seed sowing/planting methods; time and depth of sowing/planting of major crops; crop stand establishment andplanting geometry.	5
8	Intercultural operations: Weeding, mulching, thinning, earthing up, nipping, propping, staking, detopping and tying; irrigation and drainage.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain weather and climate and their influence on crops.	1, 2
	CLO2	Describe the AEZs of Bangladesh and crops grown therein.	1, 2
	CLO3	Clarify crop nutrition and suggest judicial application of manures and fertilizers.	1, 2, 3, 5
	CLO4	Describe tillage and influence of tillage on crop and soil.	1, 2
	CLO5	Narrate different planting methods and intercultural operations of crops.	1, 2

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, field visit, demonstration	Continuous assessment (Formative: Quiz, assignment, active class participation and summative) and summative (Term final)
CLO2	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Continuous assessment (Formative: Quiz, active class participation, objectives, question-answering, presentation and summative) and summative (Term final)
CLO3	Lecturing, video, field visit, debate, demonstration.	Continuous assessment (Formative: Objectives, quiz, question-answering, presentationand summative) and summative (Term final)
CLO4	Lecturing, presentation, farm visit	Continuous assessment (Formative: Quiz, short questions, MCQ and summative) and summative (Term final)
CLO5	Lecturing, field visit, presentation	Continuous assessment (Formative: Quiz, short questions, MCQ, fill in the blanks, class participation and summative) and summative (Term final)

Learning Materials

Recommended Readings	Ahmed, K. 1965. Agriculture in East Pakistan. Ahmed Bros. Pub., Dhaka. Alim, A. 1974. An Introduction to Bangladesh Agriculture. Ideal Library, Dhaka.
Supplementary Readings	De, G. C. 1997. Fundamentals of Agronomy. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi. Quddus, M. A. and Talukder, M. N. I. 1993. Krishitatter Moula Niti. Bangla Acedamy, Dhaka (In Bengali). Reddy, T. Y. and Reddi, G. H. 1995. Principles of Agronomy. Kalyani Publishers, New Delhi.

Course Code: 0811 08 AT 1102		Year: First	Term: First
Course Title	Fundamentals of Agronomy Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is designed to guide students in the identification of different crops, manures, fertilizers and farm implements. The course also intends to engage the students in accomplishing basic crop production practices.		

	Course Contents/Tasks	CLOs
1	Identify crops, farm implements, manures and fertilizers.	1
2	Determine working efficiency of farm implements.	2
3	Prepare fertilizer application plan.	3
4	Apply practical knowledge on crop raising.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify crops, farm implements, manures and fertilizers.	1
	CLO2	Determine working efficiency of farm implements.	1, 2, 5, 9, 10
	CLO3	Prepare fertilizer application plan.	1, 2, 9, 10
	CLO4	Apply practical knowledge on crop raising.	1, 2, 3, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, farm visit, study tour	Sessional assessment (Formative: Quiz, objectives, identification, report writingand viva)
CLO2	Lecturing, method demonstration, hands-on activity	Sessional assessment (Formative: Calculation, assignment, active class participation and viva)
CLO3	Lecturing, identification, method and result demonstration, group work, report writing	Sessional assessment (Formative: Pair work, question-answering, assignmentand viva)
CLO4	Lecturing, fieldwork	Sessional assessment (Formative: Continuous monitoring and viva)

Learning Materials

Recommended Readings	Ahmed, K. 1965. Agriculture in East Pakistan. Ahmed Bros. Pub., Dhaka. Alim, A. 1974. An Introduction to Bangladesh Agriculture. Ideal Library, Dhaka.
Supplementary Readings	De, G. C. 1997. Fundamentals of Agronomy. Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi. Quddus, M. A. and Talukder, M. N. I. 1993. Krishitatter Moula Niti. Bangla Acedamy, Dhaka (In Bengali). Reddy, T. Y. and Reddi, G. H. 1995. Principles of Agronomy. Kalyani Publishers, New Delhi.

Course Code: 0811 08 AT 1103		Year: First	Term: First
Course Title	Introductory Soil Science		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course intends to provide basic knowledge about soil, its origin, different branches of soil science.		

	Course Contents	CLOs
	Section A	
1	Soil genesis and formation: Introduction and concept of soil, major components of soil; soil forming rocks and minerals – classification and properties; general properties and chemical composition of minerals; soil formation – physical and chemical process of weathering; factors of soil formation – climate, biosphere, parent material, relief and time; soil forming processes – laterization, podzolization and calcification; soil profile.	1
2	Geology and geomorphology: A brief account of the geological time scale; geology of Bangladesh – tertiary hill sediments, madhupur clay and recent alluvium; geomorphology of Bangladesh – hills, terraces and floodplains.	1, 2
3	Soil physics: Soil particles – definition, classification and properties; particle size distribution analysis; Stokes' law, its assumptions and limitations; soil texture – definition, textural classes, properties and importance; particle density, bulk density and soil porosity; soil structure – definition, genesis, types, grades and classes, importance of soil structure in agriculture.	1
	Section B	CLOs
4	Soil chemistry and fertility: Concept and definition, distinction between soil fertility and productivity; introduction to essential plant nutrient elements; manures and fertilizers - distinction, kinds of manures and fertilizers with chemical composition; manures and fertilizers commonly used in Bangladesh; soil pH – definition; grading of soil according to pH values.	3
5	Soil organisms: Classification of soil organisms; soil microorganisms; procaryotes and eucaryotes; classification of soil bacteria and algae; occurrence and functions of bacteria, actinomycetes, fungi, algae and protozoa in soils; bio-fertilizer- concept and importance.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain the origin and formation of soil with its geological time scale and different geomorphology of soil.	1, 2
	CLO2	Explain different aspects of soil physical properties with its importance.	1, 3
	CLO3	Describe soil fertility and soil productivity with different kinds of manures and fertilizers.	1, 3
	CLO4	Explain the occurrence and importance of different microorganisms in crop production.	1, 6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Quiz, objectives, active class participation, assignment) and summative (Term final)
CLO2	Lecture, field visit	Continuous (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO3	Lecture, group discussion	Continuous (Formative: Viva, presentation, active class participation) and summative (Term final)
CLO4	Lecture and demonstration	Continuous (Formative: Active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Biswas, T. D. and Mukherjee, S. K. 1994. Textbook of Soil Science (2nd edition). McGraw Hill Education. Brady, N. C. 1990. The Nature and Properties of Soils. Macmillan Pub. Comp. New York. Foth, D. H. 1990. Fundamentals of Soil Science (8th edition). Wiley Publication.
Supplementary Readings	Shah, C. C. and Narayana, N. K. 1966. Physical Properties of Soil. Mankatalla. Bombay publisher, India.

Course Code: 0811 08 AT 1104		Year: First	Term: First
Course Title	Introductory Soil Science Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is planned to provide practical and applied knowledge on basic soil science including different techniques of studying soil formation.		

	Course Contents/Tasks	CLOs
1	Studies on soil sampling methods and preparation of soil sample for analysis.	1
2	Identification of important rocks and mineral specimens.	2
3	Determination of soil pH.	3
4	Study of soil profile in the field.	3
5	Mechanical analysis of soils.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain the techniques of soil sampling and its preparation technique for analysis.	1, 3
	CLO2	Identify different soil forming rocks and minerals.	1, 2
	CLO3	Demonstrate the measurement techniques of soil pH, soil moisture, soil texture and soil profile in the field.	1, 5, 6, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, group discussion, field visit	Continuous (Formative: Viva, active class participation, report writing) and summative (Term final)
CLO2	Lecture, demonstration, field visit	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)
CLO3	Lecture, demonstration, field visit	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)

Learning Materials

Recommended Readings	Biswas, T. D. and Mukherjee, S. K. 1994. Textbook of Soil Science (2nd edition). McGraw Hill Education. Brady, N. C. 1990. The Nature and Properties of Soils. Macmillan Pub. Comp. New York. Foth, D. H. 1990. Fundamentals of Soil Science (8th edition). Wiley Publication.
Supplementary Readings	Shah, C. C. and Narayana, N. K. 1966. Physical Properties of Soil. Mankatalla. Bombay publisher, India.

Course Code: 0811 08 AT 1105	Year: First	Term: First
Course Title	Agricultural Botany	
Course Status	Core	
Credit	3.0	
Prerequisite(s)	None	
Rationale	The course covers taxonomy and morphology of different crops with their economic importance.	

	Course Contents	CLOs
	Section A	
1	Introduction: Plant taxonomy- definition, branches, objectives and uses of taxonomy; brief history of taxonomy; binomial nomenclature.	1
2	External plant morphology: Characteristics, types, modification (if) and functions of different plant parts-root, stem, leaf, inflorescence, flower and fruit.	2
3	Systematic botany: The systematic study (identifying features) and economic importance of the following families-Monocots: Poaceae, Palmaceae, Araceae; Dicots- Leguminosae, Asteraceae, Cucurbitaceae, Brassicaceae, Rutaceae, Tiliaceae, Malvaceae, Solanaceae, Umbelliferae, Anacardiaceae, Moraceae.	3
	Section B	CLOs
4	Plant anatomy: Cell composition, ultra-structure and functions of the components of a typical plant cell; Cell wall - constituents of cell wall, thickening of cell wall, pits and plasmodesma.	3
5	Tissue and tissue systems: Concept and classification, characteristics features/structures, functions and distribution of different types of plant tissues, primary structures of root, stem and leaf of monocot and dicot, secondary structure of root, stem and secondary growth.	3
6	Embryology: Concept, describe the process of embryology, development of male and female gametogenesis and male gametogenesisis, fertilization and post fertilization events for whole plant formation.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Clarify plant taxonomy and nomenclature properly.	1, 2
	CLO2	Discuss different plant families with economic importance.	1, 3
	CLO3	Compare the structure and functions of plant cell, tissue and organs.	1, 2
	CLO4	Postulate gametogenesis and fertilization.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team work	Quiz and class test
CLO2	Demonstration and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Demonstration and video showing	Report writing, demonstration

Learning Materials

Recommended Readings	Sharma, O. P. 2012. Plant Taxonomy. 2nd ed. Tata Mcgraw- Hill publisher, New Delhi. Pandey, B. P. 2011. Botany for Degree Students. 5th ed. Oxford Univ. Press, Calcutta. Maheshwari, P. 2014. An Introduction to the Embryology of Angiosperms. Surjeet Publication, India.
Supplementary Readings	Gupta, R. K. 2006. Text Book of Systematic Botany. 5th ed. Atta Ram. Pub. New Delhi. Dutta, A. C. 2011. Botany for Degree Students. 4th ed. Oxford Univ. Press, Calcutta. Dutta, A. C. 2011. A Class Book of Botany. 7th ed. Oxford Univ. Press, Calcutta. Datta, S. C. 2003. Systematic Botany. 4th ed. New Age Int. Ltd. Publisher, New Dellhi.

Course Code: 0811 08 AT 1106		Year: First	Term: First
Course Title	Agricultural Botany Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is planned to familiarize students with applied knowledge on microscopy and morphology of different crops.		

	Course Contents/Tasks	CLOs
1	Study of the external morphology of the following crops - rice, maize, wheat, mustard, sunflower, jute, tobacco, potato, blackgram, lemon, mango, jackfruit and banana.	1
2	Study of simple and compound microscope - care, handling and storage of microscope.	1, 2
3	Preparation of temporary slides; sectioning, staining and mounting of plant parts (leaf. root, stem).	1
4	Microscopic study of the following - cell components, cell wall middle lamella; different types of cells in transverse and longitudinal sections; tracheids, vessels, wood fibre, seive tube etc.	1, 3
5	Anatomical study of stem and roots of maize, rice, wheat, jute, groundnut and sunflower.	1, 2, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify crops based on morphology and anatomy.	1, 2, 4, 5
	CLO2	Handle microscope carefully.	1, 2
	CLO3	Prepare temporary slide.	1
	CLO4	Distinguish different cell organelles.	1

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, group discussion, field visit	Continuous (Formative: Viva, active class participation, report writting) and summative (Term final)
CLO2	Lecture, demonstration	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)
CLO3	Lecture, demonstration	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)
CLO4	Lecture, demonstration	Continuous (Formative: Viva, active class participation, report writting) and summative (Term final)

Learning Materials

Recommended Readings	Pandey, B. P. 2011. Botany for Degree Students. 5th ed. Oxford Univ. Press, Calcutta. Sharma, O. P. 2012. Plant Taxonomy. 2nd ed. Tata Mcgraw- Hill publisher, New Delhi. Dutta, A. C. 2011. A Class Book of Botany. 7th ed. Oxford Univ. Press, Calcutta. Maheshwari, P. 2014. An Introduction to the Embryology of Angiosperms. Surjeet Publication, India. Esau, K. 1977. Anatomy of Seed Plants. 2nd ed. John Wiley, New York.
Supplementary Readings	Hill, Aj, F. 1992. Economic Botany. 2nd ed., Shreemali. Usher, G. 1992. A Dictionary of Botany. CBS publisher, India. Gupta, R. K. 2006. Text Book of Systematic Botany. 5th ed. Atta Ram. Pub. New Delhi. Pursglove, J. W. 1990. Tropical Crops. Vol. 1 & 2, Longman, London. Pandey, B. P. 2011. Botany for Degree Students. 5th ed. Oxford Univ. Press, Calcuta.

Course Code: 0314 08 Soc 1155		Year: First	Term: First
Course Title	Sociology		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course intends to instill the basics of sociological vantage point necessary to comprehend the social phenomena and how it constructs and reproduces social realities. This course will equip learners with both the fundamental knowledge and analytical skills from sociological viewpoints to understand the underlying structure and nature of human societies interpret the interrelationships among the core elements of cultures around the world and explore the wide spectrum of human relationships and behavioral patterns.		
Course Objectives	The objectives of this course are to- • introduce the students with the basic concepts and techniques of studying Sociology; • understand the scientific study of human society, culture and social interactions; • provide insights on the social forces and organizational structures shaping individual along with group behavior in contemporary society; • make students comprehend the social pathologies and their impacts on human society with remedies.		

Course Contents		CLOs
Section A		
1	Understanding sociology: Definition, nature and scope of Sociology; Major theoretical perspectives of Sociology; Research in Sociology; Necessity of studying Sociology.	1
2	Basic concepts of sociology: Society; Community; Association; Institution; Group; Norms and values; Social process.	2
3	Culture and social structure: Meaning, characteristics and function of culture; Elements of culture; Theory of cultural Lag; Culture and civilization; Definition, types and elements of social structure; Social structure in global perspective.	3
4	Socialization and social Institutions: Meaning, theories, types and agents of socialization; Major social institutions- family, marriage, kinship, religion, education and state.	3, 4
Section B		CLOs
5	Social stratification and inequality: Definition, characteristics, determinants and forms of social stratification; Meaning and dimensions of social inequality; Meaning, characteristics, types and consequences of social mobility.	5
6	Social change in global perspective: Meaning, factors and resistance to Social Change; Technology and social change; Urbanization, industrialization and social change.	5
7	Deviance, crime and social control: Deviance, crime and juvenile delinquency; Agents of social control.	6
8	Changing society of Bangladesh: Social structure of colonial Bengal; Neo-colonialism and emergence of Bangladesh; Social problems of Bangladesh.	6

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Outline the origin and development of Sociology as a distinct discipline.	1, 2
	CLO2	Comprehend the primary concepts and identify the research methods used in Sociology.	9, 11
	CLO3	Analyze the basics of culture and socialization of human beings.	10, 11
	CLO4	Explain major institutions of society, such as, social, economic, political and educational.	8, 11
	CLO5	Describe the basic dimensions of social disparity and factors of social change contemporary society.	1, 3
	CLO6	Apply the theoretical knowledge of Sociology on empirical study with regard to the social problems and issues of Bangladesh society.	2, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, discussion, question & answer session	Quiz, continuous assessment and final examination
CLO2	Lecture, presentation and question-answer session	Continuous assessment, assignment and final examination
CLO3	Lecture, brainstorming and group discussion	Assignment and final examination
CLO4	Lecture, group reading, discussion and question-answer session	Group presentation, summarization and final examination
CLO5	Lecture, group/ pair discussion and brain storming	Assignment, viva voce and final examination
CLO6	Lecture, group reading, discussion and question-answer session	Assignment, quiz and final examination

Learning Materials

Recommended Readings	Schaefer, R. T. 2013. Sociology: A Brief Introduction. McGraw Hill Higher Education. Giddens, A. and Sutton, P. W. 2017. Sociology. Polity Press. Smelser, N. J. 1967. Sociology: An Introduction. Wiley. Henslin, J. M. 2014. Essentials of Sociology. Pearson. Stewart, E. W. and Glynn, J. A. 1979. Introduction to Sociology. McGraw-Hill.
Supplementary Readings	Smelser, N. J. 1988. The Handbook of sociology. Sage Publications.

Course Code: 0531 08 Chem 1159		Year: First	Term: First
Course Title	Chemistry		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide basic knowledge of chemistry for the students of agriculture to admit soil-, water-, fertilizer-, and pesticide-chemistry along with basics of organic and inorganic chemistry.		
Course Objectives	To offer students with foundation knowledge of chemistry required in the field of agriculture		

Course Contents		CLOs
	Section A	
1	Introduction to chemistry: Definition and scope; the nature and composition of matter; the chemical structure of matter.	1
2	Atomic structure and the periodic table: Early views, atomic spectra of hydrogen and the Bohr theory, Bohr-Sommerfield model, quantum number; wave mechanical approach; atomic orbital, build-up elements, the periodic table of the elements, atomic properties and the periodic table.	1
3	The structure of molecules: The origin of bonding, types of bonding; covalent vs ionic bonding: bond polarity, bonding of some representative molecules and their chemical geometry.	2
4	Chemical reaction and stoichiometry: Synthesis in chemistry, the stoichiometry of chemical reactions, precipitation reactions, acid-base reactions and Oxidation-reduction reactions: ion electron method for balancing redox reactions.	2
5	Introduction to analytical chemistry: Chemical analysis, types of analysis, volumetric analysis: types of volumetric analysis, acid-base titration, oxidation-reduction titration, precipitation titration and complexometric titration, colorimetry and spectrophotometric analysis: Lambert and Beer's law and its application.	2
	Section B	CLOs
6	Matter and energy: heat and work: The first law of thermodynamics, heat of reaction; enthalpies, the Second law of thermodynamics; entropy, the third law; absolute entropies, a general criterion for spontaneous change; the Gibb's free energy.	3
7	System in equilibrium: Physical equilibriam; Raoult's law to dilute solution, non-ideal solution: Henry's laws, application of Raoult's law to dilute solution: colligative properties, chemical equilibrium, the law of mass action, equilibrium constant, Lecheteliatr principle, equilibria in ionic solutions, acid-base equilibria, concept of pH and buffer solution.	4
8	Introduction to organic chemistry: Aliphatic hydrocarbon, halogen derivatives of aliphatic hydrocarbon, alcohol, aldehyde, ketones, carboxilic acid, esters and amines; structure, properties and some representative reactions with special reference to functional groups, modern concepts of the structure of benzene and its derivatives.	5

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Discuss about the nature and composition of matter, atomic structure and the periodic table.	2
	CLO2	Analyze different chemical reactions along with physico-chemical equilibrium of them.	2, 3
	CLO3	Narrate various laws of thermodynamics.	9
	CLO4	Discuss first and Second order reactions.	2
	CLO5	Conceptualize organic chemistry.	2, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, presentation	Formative (Quiz, objectives, active class participation), summative
CLO2	Lecturing, group discussion, video, assignment	Formative (Quiz, assignment, objectives, active class participation), summative
CLO3	Lecturing, group discussion, video, report writing	Formative (Objectives, quiz, question-answering, presentation), summative
CLO4	Lecturing, group discussion, assignment, video, debate	Formative (Viva, quiz, short questions, MCQ, presentation), summative
CLO5	Lecturing, group discussion, presentation, video	Formative (Viva, quiz, short questions, MCQ, presentation), summative

Learning Materials

Recommended Readings	Ahmed, M. and Main, A. I. 1972. A Text Book of Organic Chemistry. 3rd ed., Ghani Art Press, Bangla Bazar, Dhaka. Gregory M. O. and Williams, J. A. 2005. Chemistry: The Molecular Science, John Wiley & Sons Inc. Finar, I. L. 1973. Organic Chemistry. Vol. 1, 6th ed., English Laanguage Book Society. Coxon, J. M., Fergusson, J. E. and Phillips, L. F. 1980. First Year Chemistry. Edward Arnold Pub. Ltd.
Supplementary Readings	Haider, S. Z. 2000. Introduction to Modern Inorganic Chemistry. Students Publications P.K. Roy Lane, Dhaka. Hopue, M. M. and Nawab, M. A. 1974. Principles of Physical Chemistry. 3rd ed., Students Publications, Dhaka. Khalique, A. 1971. Organic Chemistry. Ideal Library, Bangla Bazar, Dhaka. Liptrot, G. F. 1983. Modern Inorganic Chemistry. 4th ed., HarperCollins Publications. Morrison, R. T. and Boyd, R. N. 1983. Organic Chemistry. 4th ed., Allyn and Bacon, Inc. Boston. Online Resources

Course Code: 0531 08 Chem 1160		Year: First	Term: First
Course Title	Chemistry Sessional		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide practical skills of chemistry for the students of agriculture to deal with organic and inorganic chemistry in the field of agriculture.		
Course Objectives	To equip the students with the basic practical skills of chemistry required in the field of agriculture.		

	Course Contents/Tasks	CLOs
1	Preparation of standard solutions.	1
2	Volumetric analysis: Acid-base titration; determination of the strength of acid/base by using standard base/acid solution respectively.	1, 2
3	Oxidation-reduction titration: Determination of the amount of iron (in grams per litre) of the given ferrous sulphate solution by standard potassium permanganate solution.	1
4	Iodometric titration: Determination of the amount of copper (in grams per litre) of a given copper sulphate solution by using standard sodium thiosulphate solution.	1
5	Precipitation titration: Determination of salinity of a water sample	1, 3
6	Complexometric titration: Determination of Ca and Mg from water sample.	1, 3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Prepare different types of chemical solutions and practice titration.	3
	CLO2	Determine strength of acids and bases.	3, 9
	CLO3	Determine salinity and estimate Ca and Mg of water sample.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Demonstration in the lab, discussion, calculation, report writing	Formative (Quiz, objectives, active class participation), summative
CLO2	Demonstration in the lab, discussion, calculation, report writing	Formative (Quiz, assignment, objectives, active class participation), summative
CLO3	Demonstration in the lab, discussion, calculation, report writing	Formative (Objectives, quiz, question-answering, presentation), summative

Learning Materials

Recommended Readings	Ahmed, M. and Main, A. I. 1972. A Text Book of Organic Chemistry. 3rd ed., Ghani Art Press, Bangla Bazar, Dhaka. Gregory M. O. and Williams, J. A. 2005. Chemistry: The Molecular Science, John Wiley & Sons Inc. Finar, I. L. 1973. Organic Chemistry. Vol. 1, 6th ed., English Laanguage Book Society. Coxon, J. M., Fergusson, J. E. and Phillips, L. F. 1980. First Year Chemistry. Edward Arnold Pub. Ltd.
Supplementary Readings	Haider, S. Z. 2000. Introduction to Modern Inorganic Chemistry. Students Publications P.K. Roy Lane, Dhaka. Hopue, M. M. and Nawab, M. A. 1974. Principles of Physical Chemistry. 3rd ed., Students Publications, Dhaka. Khalique, A. 1971. Organic Chemistry. Ideal Library, Bangla Bazar, Dhaka. Liptrot, G. F. 1983. Modern Inorganic Chemistry. 4th ed., HarperCollins Publications. Morrison, R. T. and Boyd, R. N. 1983. Organic Chemistry. 4th ed., Allyn and Bacon, Inc. Boston. Online Resources

Course Code: 0541 08 Math 1161		Year: First	Term: First
Course Title	Mathematics		
Course Status	Optional		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is designed to apply their practical knowledge and skills for the solution of theoretical and practical problems of mathematics.		

	Course Contents	CLOs
	Section A	
1	Deferential calculus functions: Understanding the geometric behavior of elementary functions and families of curves; $y = mx + c$, $y = x^n$, $y = \frac{1}{x^n}$, $logx$, lnx, e^x, domain and range of functions, graph of functions.	1
2	Basics concepts of limit and continuity.	1
3	Differentiation of different types of functions e.g. parametric and explicit etc. differentials, differentiability and physical meaning of differentiation; application of differentiation.	1
4	Basics of successive and partial differentiation.	2
5	Maxima and minima of functions.	1
	Section B	CLOs
6	Basics of integration: Definite and indefinite, proper and improper integrals, antiderivative physical meaning of integration.	3
7	Methods of integration: Integration by substitution and integration by parts.	2
8	Definite integrals: Properties and application of definite integrals.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Make differentiation of various types of function.	1, 2
	CLO2	Apply of differentiation and integration of different issues related to agriculture.	1
	CLO3	Explain various methods of integration in agricultural science.	1, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Active class participation, assignment) and summative (Term final)
CLO2	Lecture, video	Continuous (Formative: Quiz, active class participation) and summative (Term final)
CLO3	Lecture, group discussion, video	Continuous (Formative: Written test, assignment) and summative (Term final)

Learning Materials

Recommended Readings	Hall, H.S. and Knight S.R. 1961. Higher Algebra. Macmillan and Co. Ltd. New York. Mohammad, K. and Bahttacharjee, P.K. 1988. A Text Book on Differential Calculus. S. Tripaty, Chittagong. Mohammad, K. and Bhattacharjee, P.K. 1987. A Text Book on Integral Calculus. H. Bhattacharjee, Chittagong.
Supplementary Readings	Peterson, G. L. 1989. Algebra and Trigonometry. Works worth Publication Company, Beont, California. Shahidullah, A. M. A. and Bhattacharjee, P.K. 1988. A Text Book on Higher Algebra and Trigonometry. H. Bhattacharjee, Chittagong.

First Year Second Term			
Course Code: 0811 08 AT 1201		Year: First	Term: Second
Course Title	Weed Management		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course is designed to provide basic knowledge on weeds and weed management.		

	Course Contents	CLOs
	Section A	
1	Introduction: Definition, characteristics and classification of weeds; harmful and beneficial effect of weeds; crop loss due to weeds.	1
2	Reproduction and survival of weeds: Propagation, dispersal and persistence of weeds, weed seed bank.	1
3	Distribution of weeds: Distribution of weeds in relation to land topography, soil, seasons, crops agronomic practices.	1
4	Crop-weed association: Concept and causes; name of crops with their associated weeds; crop-weed competition - concept, critical period and factors affecting crop-weed competition; allelopathy and allelochemicals.	2
	Section B	CLOs
5	Weed management: Concept and principles; prevention, eradication and control methods; mechanical, cultural, biological and chemical methods of weed control; integrated weed management.	3, 4
6	Herbicides: Classification, formulation and mode of action of herbicides; selectivity of herbicides, factors affecting selectivity; methods, doses and time of herbicides application; factors affecting the foliage and soil applied herbicides; herbicidal weed control in major crops of Bangladesh- rice, wheat, jute, cotton, sugarcane; effect of herbicides on crops and environment.	3, 4, 5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Discuss mode of reproduction, survival of weeds and factors governing weed distribution.	1, 2, 5
	CLO2	Justify crop-weed association, competition and allelopathy.	1, 5
	CLO3	Formulate guidelines on weed management strategies.	1, 5
	CLO4	Describe herbicides with their uses, selectivity & mode of action.	1
	CLO5	Prescribe for judicial use of herbicides.	2

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion	Continuous assessment (Formative: Quiz, assignment, active class participation and summative) and summative (Term final)
CLO2	Lecturing, discussion, video presentation	Continuous assessment (Formative: Quiz, active class participation, objectives, question-answering and summative) and summative (Term final)
CLO3	Lecturing, video, field visit, debate, demonstration	Continuous assessment (Formative: Objectives, quiz, question-answering, MCQ, presentation and summative) and summative (Term final)
CLO4	Lecturing, presentation, farm visit, video	Continuous assessment (Formative: Objectives, quiz, question-answering, MCQ, presentation and summative) and summative (Term final)
CLO5	Lecturing, field visit, presentation	Continuous assessment (Formative: Objectives, quiz, question-answering, MCQ, presentation and summative) and summative (Term final)

Learning Materials

Recommended Readings	Gupta, O. P. 1998. Modern Weed Management. Agro-botanica, Bikaner, India. Hance, R. J., and Holy, K. 1990. Weed Control Hand Book: Vol.-11, Blackweel Scientific Publication, Oxford, London.
Supplementary Readings	Karim, S. M. R and Kabir, M. H. 1995. Bangladesher Agacha Porichiti. Bangla Academy. Dhaka. Rao, V. S. 1994. Principles of Weed Science. Oxford & IBH pub. Co. Pvt. Ltd. New Delhi. Subramanian, S., Mohamed, A. and Jayakumar, R. 1997. All About Weed Control. Kalyni Publishers, New Delhi.

Course Code: 0811 08 AT 1202		Year: First	Term: Second
Course Title	Weed Management Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is planned to provide practical knowledge on weeds and their management.		

	Course Contents/Tasks	CLOs
1	Identification of common weeds and preparation of a herbarium.	1
2	Morphological study of major weeds of Bangladesh emphasizing their propagating organs.	2
3	Calculation of herbicide dosage; calibration of sprayer.	3
4	Practicing herbicide application by different methods; determination of the efficiency of different sprayers/methods.	4
5	Observation of the effect of herbicides on crop and weed.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe external morphology of some important weeds of Bangladesh.	1, 2
	CLO2	Identify different weed species.	1
	CLO3	Calculate and apply herbicides in crop field judiciously.	1, 2, 3, 5, 11
	CLO4	Formulate guidelines on weed management strategies.	1, 3, 5, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, farm visit, demonstration	Sessional assessment (Formative: Identification, homework and viva)
CLO2	Lecturing, laboratory work, demonstration, field visit	Sessional assessment (Formative: Laboratory study, objective and viva)
CLO3	Lecturing, field visit, group work	Sessional assessment (Formative: Objective, problem solving and viva)
CLO4	Video, demonstration, pair work, case study	Sessional assessment (Formative: Manual skill demonstration, presentation and viva)

Learning Materials

Recommended Readings	Gupta, O. P. 1998. Modern Weed Management. Agro-botanica, Bikaner, India. Hance, R.J. and Holy, K. 1990. Weed Control Hand Book: Vol.-11, Blackweel Scientific Publication, Oxford, London. Karim, S. M. R., and Kabir, M. H. 1995. BangladesherAgacha Porichiti. Bangla Academy. Dhaka.
Supplementary Readings	Rao, V. S. 1994. Principles of Weed Science. Oxford & IBH pub. Co. Pvt. Ltd. New Delhi. Subramanian, S. Mohamed Ali, A. and Jayakumar, R. 1997. All About Weed Control, Kalyni Publishers, New Delhi.

Course Code: 0811 08 AT 1203		Year: First	Term: Second
Course Title	Fundamentals of Horticulture		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	The graduates will be provided with the basic knowledge on horticulture and relevant issues to familiarize them with the fundamental aspects of horticultural science.		
Course Objectives	To give the students an outline on different perspectives of horticultural science.		

	Course Contents	CLOs
	Section A	
1	Introduction: Definition, history, branches, scope and importance of horticulture.	1
2	Propagation of horticultural crops: Definition, methods of plant propagation and their advantages and disadvantages; uses of growth regulators in propagation, propagation by specialized plant parts - graftage, cuttage, layerage, apomixis and polyembryony; factors affecting root initiation in cutting and layering; incompatibility in grafting; principles and practices of raising horticultural crops.	2
3	Principles and practices in horticulture: Principles of planning an orchard, flower and vegetable garden; site selection for orchards, vegetables and ornamentals.	3
	Section B	CLOs
4	Planting system: Planting methods, layout of orchard in different planting system, soil and land preparation, plant spacing, manure and fertilizer application, irrigation and drainage, intercultural operations.	3
5	Nursery practices: Horticulture nursery, different sections of horticulture nursery, nursery bed preparation, raising of seedlings in nursery beds; potting, depotting and repotting; factors affecting spacing, irrigation and fertilizer doses; calendar of nursery activities, different type of protecting structures (greenhouse, lathe house, net house, mist propagation unit, hot bed, cold frame) and protection measures in them.	4
6	Introduction to pruning, training and bearing habit: Concepts, objectives, principles, methods, types and effects of pruning and training, bearing habit and its classification.	5
7	Harvesting and handling of horticultural crops: Harvesting, sorting, grading, packaging, transportation and marketing of horticultural crops.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Classify and explain the importance and scopes of horticulture.	1
	CLO2	Differentiate various propagation techniques with their practical applications.	2, 4
	CLO3	Select the principles, practices and layout of planting systems for horticultural crops.	3, 9
	CLO4	Illustrate horticulture nursery management practices.	2, 4, 9
	CLO5	Discuss pruning-training, bearing habits, harvesting and handling of horticultural crops.	5

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and discussion	Formative (Quiz, objectives, active class participation) and summative
CLO2	Lecture, video demonstration and discussion	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstration field visit, group discussion, report writing	Formative (Objectives, quiz, question-answering, presentation) and summative
CLO4	Lecturing, group discussion, demonstration, presentation, field visit	Formative (Objectives, quiz, short questions, MCQ, presentation) and summative
CLO5	Lecturing, demonstration, presentation, assignment	Formative (Viva, quiz, short questions, MCQ, presentation) and summative

Learning Materials

Recommended Readings	Andriance, G. W. and Brison, F. R. 2000. Propagation of Horticultural plants. McGraw Hill Book Company, New York. Bose, T. K., Mitra, S. K. and Sadhu, M. K. 2001. Propagation of Tropical and Subtropical Horticultural crops. Nayaprokash. Calcutta, India. Christopher, E.P. 1998. Introductory Horticulture. Macmillan Co., New York. Edmond, J. B., Senn, T. L. Andrews, F. S. and Halfacre, R. G. 2002. Fundamentals of Horticulture. McGraw Hill Book Company. New York. Hartman, H. T., Kester, D. E. and Davies Jr. F. T. 2004. Plant propagation: Principles and practices. Prentice Hall International Inc.
Supplementary Readings	Janicks, J. 2000. Horticultural Science. Purdue University, Sanfransisko, USA. Samson, J.A. 2001. Tropical Fruits. Longman London and New York. Prasad, S. and Kumar, U. 2008. Principles of Horticulture. 2nd ed. Dr. Updesh Purohit for Agrobios. Joypur, India. Singh, N. P. 2006. Terminology of Horticulture. International Book Distributing Co., Charbagh, Lucknow, India. Gupta, S. N. and Naik, K. B.2008. Instant Horticulture. 4th ed. Shri Sunil Kumar Jain for Jain Brothers. New Delhi. Rahim, M. A.2009. Nursery Plants. 1st ed. Jahangirnagar University, Dhaka, Bangladesh. Acqueah, G. 2009. Horticulture Principles and Practices. 2nd ed. International Book Distributing Co. Sandini, M. G. 1911. Plant Propagation and Nursery Management Manual.

Course Code: 0811 08 AT 1204		Year: First	Term: Second
Course Title	Fundamentals of Horticulture Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is comprised with propagation techniques, layout, pruning-training and cultural practices to develop skills and practical knowledge of students on these topics for horticultural crops.		
Course Objectives	To give the students an outline on different perspectives of propagation techniques, layout, pruning -training and cultural practices of horticultural crops.		

	Course Contents/Tasks	CLOs
1	Propagation practices of important ornamental and fruit plants.	2
2	Identification and uses of nursery equipments.	1
3	Pruning and training practices of important horticultural crops.	2
4	Practices on potting, depotting and repotting of plant.	2
5	Practicing layout in different planting systems.	4
6	Preparation of seedbed and nursery bed.	3
7	Practices on different intercultural operations.	4
8	Harvesting methods of horticultural crop.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify nursery equipment.	1, 2, 9
	CLO2	Demonstrate propagation techniques, pruning and training, potting, depotting and repotting of horticultural crops.	1, 2, 3, 5, 9
	CLO3	Prepare seedbed and nursery bed.	2, 9
	CLO4	Practice site selection, layout, intercultural operations and harvesting methods for horticultural crops.	3, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration and group discussion, assignment	Formative (Quiz, performance evaluation, active class participation) and summative
CLO2	Lecture, video demonstration and discussion	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstration, group discussion	Formative (Objectives, quiz, question-answering, presentation) and summative
CLO4	Lecturing, group discussion, demonstration, presentation, field visit, report writing	Formative (Objectives, quiz, short questions, MCQ, presentation) and summative

Learning Materials

Recommended Readings	Acqueah, G. 2009. Horticulture Principles and Practices. 2nd ed. International Book Distributing Co. Andriance and Brison. 2000. Propagation of Horticultural Plants. McGraw Hill Book Company, N. Y. Bose, T. K., Mitra, S. K. and Sadhu, M. K. 2001. Propagation of Tropical and Subtropical Horticultural crops. Nayaprokash. Calcutta, India. Christopher, E.P. 1998. Introductory Horticulture. Macmillan Co., New York. Edmond, J. B., Senn, T. L. Andrews, F. S. and Halfacre, R. G. 2002. Fundamentals of Horticulture. McGraw Hill Book Company. New York.
Supplementary Readings	Gupta, S. N. and Naik, K. B.2008. Instant Horticulture. 4th ed. Shri Sunil Kumar Jain for Jain Brothers, New Delhi. Hartman, H. T., Kester, D. E. and Davies Jr. F. T. 2004. Plant propagation: Principles and practices. Prentice Hall International Inc. Jules Janicks. 2000. Horticultural Science. Purdue University, Sanfransisko, USA. Prasad, S. and Kumar, U.2008. Principles of Horticulture. 2nd ed. Dr. Updesh Purohit for Agrobios. Joypur, India. Rahim, M. A.2009. Nursery Plants. 1st ed. Jahangirnagar University, Dhaka, Bangladesh. Samson, J.A. 2001. Tropical Fruits. Longman London and New York. Singh, N. P. 2006. Terminology of Horticulture. International Book Distributing Co., Charbagh, Lucknow, India.

Course Code: 0811 08 AT 1205		Year: First	Term: Second
Course Title	Introductory Animal and Poultry Science		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course covers fundamental concepts of animal and poultry science and practices in livestock and poultry production		
Course Objectives	To discuss the basic concepts of animal and poultry science, along with the ecology and management practices of livestock and poultry		

Course Contents		CLOs
Section A		
1	Introduction: Definition and scope of animal husbandry and animal science; zoological classification of livestock; importance of livestock and its economic impact on farming system of Bangladesh; constraints of livestock production in Bangladesh and ways to overcome the problems; terminology related to livestock production; castration of cattle.	1, 2
2	Types and uses of livestock: Large ruminants- classification according to use; origin and characteristics of important tropical and temperate dairy breeds; principles of selection and judging of dairy, small ruminants- importance of goat and sheep and their effect on rural economy; origin and characteristics of important breeds of goats.	2, 3
Section B		CLOs
3	Livestock ecology: Definition and branches of ecology; relationship of ecology with other disciplines; behavior of domestic animals; components of the livestock ecology wheel; characteristics of major climatic zones of the animal world; physiological and environmental factors related to dairy and beef cattle production; acclimatization of exotic cattle in Bangladesh.	4, 5, 6
4	Poultry: Introduction to poultry and poultry science; history, origin and domestication of poultry; characteristics of poultry birds; importance of poultry and its economic impact on the farming system of Bangladesh; zoological classification; constraints of poultry production in Bangladesh and ways to overcome the problems; terminology; classification and characteristics of different classes of poultry; origin and characteristics of important breeds and varieties of chicken; modern strains of chicken; housing-objectives, types, requisites of good housing equipment.	1, 2, 7

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify and classify different breeds of livestock and poultry.	1
	CLO2	Explain the importance and constraints of livestock and poultry production in Bangladesh and ways to overcome it.	10
	CLO3	Judge cattle for various purposes.	1
	CLO4	Discuss fundamentals of animal behavior.	1, 2
	CLO5	Compare and contrast major climatic zones of the animal world.	1, 2
	CLO6	Narrate physiological and environmental factors related to livestock production.	1, 2
	CLO7	Explain objectives of livestock and poultry housing and its types.	4

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Quiz and class test
CLO5	Lecturing, discussion	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecture and team teaching	Quiz and class test

Learning Materials

Recommended Readings	Banerjee, G.C. 2011. A Text Book of Animal Husbandry. 8th ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. Charles, B. 1927. Animal Ecology. Sidgwick and Jackson Ltd., London. Gopalkrishna, C. A. and Lal, G.M.M. 1994. Livestock and Poultry Enterprises for Rural Development. Vikas Publishing Housing Ltd. New Delhi. Kumar, A. 2006. Animal Husbandry. 1st ed. Discovery Publishing House, New Delhi.
Supplementary Readings	Prasad, J. 2010. Goat, Sheep and Pig Production and Management. Kalyani Publishers, New Delhi. Ranjhan, S. K. 2001. Animal Nutrition in the Tropics, S.Chand (G/L) & Company Ltd. Sastry, N.S.R. and Thomas, C.K. 2005. Livestock Production Management. 4th ed., Kalyani Publishers, New Delhi. Singh, R. 2009. Essentials of Animal Production and Management. 2nd ed., Kalyani Publishers, New Delhi. Verma, P. S. 2000. Animal Physiology and Ecology. S. Chand and Co. Ram Nagar, Delhi, India. Verman, D.N. 2005. A Text Book of Livestock Production Management in Tropic. Kalyani Publishers, New Delhi. Williamson, G and Payne, W. J. A. 1978. An Introduction to Animal Husbandry in the Tropics. English Language Book Society and Longman Group Ltd.

Course Code: 0811 08 AT 1206		Year: First	Term: Second
Course Title	Introductory Animal and Poultry Science Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is designed to guide students for handling of livestock and identification of different livestock and poultry breeds. The course also intends to engage students in the use of livestock and poultry production practices.		
Course Objectives	To offer applied knowledge on livestock and poultry handling, body weight measurement, farm record keeping and their housing. To involve students in livestock and poultry production management practices.		

	Course Contents/Tasks	CLOs
1	Approach and handling of livestock and different points of cattle.	1
2	Identification of different breeds of cattle.	2
3	Methods of determining body measurements and live weight of livestock.	3, 4
4	Record keeping of farm animals and collection of data related to livestock production.	4
5	Introduction to different body parts of chicken and ducks.	5
6	Identification of different breeds and strains of chicken.	2
7	Visits of govt. and private farms of poultry, cattle, goats and buffaloes.	6

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain approach and handling of livestock.	1, 9
	CLO2	Identify different breeds of cattle and goats; and poultry.	2
	CLO3	Determine different body parts of livestock and poultry.	9
	CLO4	Estimate live weight of livestock.	9
	CLO5	Prepare record keeping of farm animals.	10
	CLO6	Analyze the activities of GOs and NGOs livestock and poultry farm in Bangladesh.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation
CLO5	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation
CLO6	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation

Learning Materials

Recommended Readings	Banerjee, G.C. 2011. A Text Book of Animal Husbandry. 8th ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. Charles, B. 1927. Animal Ecology. Sidgwick and Jackson Ltd., London. Gopalkrishna, C. A. and Lal, G.M.M. 1994. Livestock and Poultry Enterprises for Rural Development. Vikas Publishing Housing Ltd. New Delhi. Kumar, A. 2006. Animal Husbandry. 1st ed. Discovery Publishing House, New Delhi.
Supplementary Readings	Prasad, J. 2010. Goat, Sheep and Pig Production and Management. Kalyani Publishers, New Delhi. Ranjhan, S. K. 2001. Animal Nutrition in the Tropics, S.Chand (G/L) & Company Ltd. Sastry, N.S.R. and Thomas, C.K. 2005. Livestock Production Management. 4th ed., Kalyani Publishers, New Delhi. Singh, R. 2009. Essentials of Animal Production and Management. 2nd ed., Kalyani Publishers, New Delhi. Verma, P. S. 2000. Animal Physiology and Ecology. S. Chand and Co. Ram Nagar, Delhi, India. Verman, D.N. 2005. A Text Book of Livestock Production Management in Tropic. Kalyani Publishers, New Delhi. Williamson, G and Payne, W. J. A. 1978. An Introduction to Animal Husbandry in the Tropics. English Language Book Society and Longman Group Ltd.

Course Code: 0811 08 AT 1207		Year: First	Term: Second
Course Title	Introductory Entomology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is designed to focus on the fundamental knowledge of entomology emphasizing insect developmental history, arthropod classification, morphology, molting and metamorphosis and finally systematic entomology.		

	Course Contents	CLOs
	Section A	
1	Introduction: Concept and global developmental history of entomology.	1
2	Arthropoda: General characteristics; classification with diagnostic features; evolution of insects (phylogeny); distinguishing features of class Insecta, Arachnida, Crustacea and their relatives, importance of insects, spiders and mites in agriculture.	1, 2
3	Insect morphology: External morphology of insects; insect body parts: head, thorax and abdomen, various types of antennae, mouthparts and legs, basic pattern of wing venation, modification of insect wings, structure and function of insect integument.	3
4	Molting and metamorphosis: Perceptions and significance, steps and mechanism of molting, types of metamorphosis, types of larvae and pupae of insects.	3
	Section B	CLOs
5	Systematic entomology: Perceptions and importance of insect systematics, phylogenetics and integrative taxonomy with a preference to broad biological, evolutionary or zoogeographical relevance.	4
6	Insect orders: Classification, ecological significance and diagnostic features of major insect orders in perspective of crop production and preservation.	5
7	Insect families: Diagnostic characteristics, habitats and importance of crucial insect families of the orders – Thysanura, Odonata, Orthoptera, Dictyoptera, Thysanoptera, Dermaptera, Isoptera, Anoplura, Hemiptera, Homoptera, Lepidoptera, Coleoptera, Diptera, Hymenoptera, Strepsiptera and Ephimeroptera.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain the developmental history of entomology and contrast among Arthropoda, Insect, Arachnida, Crustacea and their relatives.	1, 2, 7
	CLO2	Identify and compare modifications of insects' antennae, mouthparts, legs and wings alongside insect larval and pupal types.	1, 5, 7
	CLO3	Summarize insect molting and metamorphosis processes with its ecological importance.	1, 2, 6, 9
	CLO4	Analyze systematics, phylogenetics and integrative taxonomy in broad biological, evolutionary or zoogeographical aspects.	1, 2, 7
	CLO5	Characterize and compare different insect orders and families on their salient diagnostic features and judge them based on their economic importance in agriculture.	1, 6, 7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion and demonstration/ PPT	Quiz, assignment and class participation
CLO2	Lecturing, video, brainstorming and demonstration/ PPT	Quiz, assignment, presentation, objectives, and class participation
CLO3	Lecturing, video, demonstration/ PPT and assignment	Quiz, question-answering and presentation
CLO4	Lecturing, panel discussion, demonstration/PPT, presentation and case study	Quiz, short questions and presentation
CLO5	Group discussion, demonstration, presentation, debate and assignment	Viva, quiz, short questions and presentation

Learning Materials

Recommended Readings	Richards, O. W. and Davies, R. G. 2014. IMMS' General Textbook of Entomology, 10th ed. Vol – I&II. Springer, Netherlands. Chapman, R. F., Simpson, S. J. and Douglas, A. E. 2012. The Insects: Structure and Function, 5th ed. Cambridge University Press, Cambridge, England. Gullan, P. G. and Cranston, P. S. 2014. The Insects: An Outline of Entomology, 5th ed. Wiley-Blackwell, New Jersey, USA. Gordh, G. and Headrick, D. H. 2001. A Dictionary of Entomology, 1st ed. CAB International, UK.
Supplementary Readings	Kachhwaha, N. 2016. Principles of Insect Morphology and Systematics. New Delhi, India. Snodgrass, R. E. 2004. Principles of Insect Morphology, 5th ed. Cornell University Press, Ithaca, New York, USA. Saxena, A. B. 2004. Principles of Insects Morphology. Anmol Publications Pvt Ltd., New Delhi, India. Peter, K.V. 1998: Genetics and Breeding of Vegetables. Published by Directorate of Information and Publications of Agriculture. New Delhi.

Course Code: 0811 08 AT 1208	Year: First	Term: Second
Course Title	Introductory Entomology Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	The sessional is designed to provide hands-on experience on methods of insect collection, preservation, slide preparation and identification of insects belonging to different orders and families.	

	Course Contents/Tasks	CLOs
1	Methods of collection, preparation and preservation of insect eggs, immature and adult stages, spiders and mites.	1
2	Preparation of temporary and permanent slides of antennae, mouthparts, legs, wings and scales of insects.	2
3	External morphology of grasshopper, various types of antennae, legs, mouthparts and wings of insects.	2
4	Collection and identification of insects of economic importance in Bangladesh.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify, collect, and preserve immature stages of insets.	1, 4, 5, 7
	CLO2	Dissect and prepare slide of insect external body parts.	2, 4, 9
	CLO3	Solve any problem associated with insect taxonomy and systematics.	1, 2, 4, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Discussion, group work, demonstration/ PPT and dissection	Quiz, assignment, class participation and Laboratory and fieldwork evaluation
CLO2	Brainstorming, lecturing, dissection, demonstration/ PPT, small group discussion and problem solving	Quiz, assignment, presentation, class participation and laboratory and fieldwork evaluation
CLO3	Lecturing, video, demonstration/ PPT and case study	Objectives, laboratory and fieldwork evaluation question-answering and presentation

Learning Materials

Recommended Readings	Oman, P. W. and Arthur, D. 2005. Collection and Preservation of Insects. Fredonia Press, Washington D.C., USA.
Supplementary Readings	Online resources

Course Code: 051 08 AT 1209		Year: First	Term: Second
Course Title	Biochemistry		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The content of the course includes macromolecules (carbohydrate, protein, lipid, and nucleic acid), enzymes, vitamins, Secondary metabolites and metabolism to provide basic and vital knowledge on these topics to the students.		
Course Objectives	To ensure understanding of the students on various aspects of macromolecules, enzymes, vitamins, secondary metabolites and metabolism in living organism with a particular reference to plant.		

Course Contents		CLOs
Section A		
1	Introduction: History, scope and future prospect of biochemistry.	1
2	Carbohydrates: Nomenclature, occurrence, classification, physical and chemical properties; composition and chemical linkages of polysaccharides with special reference to starch, cellulose and cell wall polysaccharides.	2, 3
3	Proteins: Definition, classification, physical and chemical properties, amino acids and peptides, essential amino acids, plant protein – leaf, seed and cereal protein, biological value of animal and plant proteins.	2, 3
4	Lipids: Definition, classification, general reaction of fats, fatty acids and essential fatty acid, characterization of fats, oils and waxes, phospholipids, biological function of lipid.	2, 3
5	Nucleic acids: Occurrence, composition and classification, physical and chemical properties, Watson – Cricks DNA model, types of RNA, important functions of nucleic acid.	2, 3
Section B		CLOs
6	Enzymes: Nomenclature, classification, characteristics structure, mode of action of enzymes, factors affecting enzyme activity, enzyme kinetics, enzyme inhibition, biological role of enzyme.	4
7	Vitamins: Definition, occurrence and classification, physical and chemical properties; physiological functions of vitamins.	4
8	Metabolism: Anabolism and catabolism, central pathway of metabolism and anaplerotic pathway, carbohydrate, fat and protein metabolism and their relationship; distinguishing features of plant metabolism; glyoxalic acid cycle and alpha oxidation and beta oxidation.	5
9	Secondary metabolites: Origin, types, distribution and functions in plant.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Narrate the historical perspectives and future prospects of biochemistry.	3
	CLO2	Classify and differentiate macromolecules (carbohydrate, protein, lipid, nucleic acid) along with their physical and chemical properties.	3
	CLO3	Explain the structure and functions of carbohydrate, protein, lipid, and nucleic acid.	9
	CLO4	Analyze the mode of action and functions of enzymes, vitamins, and Secondary metabolites.	3, 9
	CLO5	Describe metabolisms in detail.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, presentation	Formative (Quiz, objectives, active class participation), summative
CLO2	Lecturing, group discussion, video, assignment	Formative (Quiz, assignment, objectives, active class participation), summative
CLO3	Lecturing, group discussion, video, report writing	Formative (Objectives, quiz, question-answering, presentation), summative
CLO4	Lecturing, group discussion, assignment, video, report writing	Formative (Viva, quiz, short questions, MCQ, presentation), summative
CLO5	Lecturing, group discussion, presentation, video, debate	Formative (Viva, quiz, short questions, MCQ, presentation), summative

Learning Materials

Recommended Readings	Conn, E.E. and Stumpe, P.K. 1987. Outlines of Biochemistry, 5th ed. J. Wiley and Sons, New York. Goodwin, T. W. and Mercer, E. I. 2003. Introduction to Plant Biochemistry. CBS Publishers and Distributors. New Delhi, India. Jeremy, M. B., Tymoczko, J.L, and Stryer, L. 2002. Biochemistry. WH Freeman. Karet, R.L., Denniston, K.J. and Topping, J.J. 1997. Principles and Applications of Inorganic, Organic and Biological Chemistry. WCB, McGraw-Hill
Supplementary Readings	Kretovich, V.H., Nowarowski, T.Z. and Clarke, A.J. 1996. Principles of Plant Biochemistry. Pergamon Press. Oxford. London, New York. Paris. Krogmann, D.W. 1993. The Biochemistry of Green Plants. Prentice Hall of India Pvt. Ltd. New Delhi. Nelson, D. L. and Cox, M, M. 2007. Lehninger Principles of Biochemistry. WH Freeman and Company. Srivastava, L. L. 2004. Concepts of Biochemistry. CBS Publishers and Distributors. New Delhi, Bangalore. Verma, S.K. and Verma, M. 2012. A Text Book of Plant Physiology and Biochemistry. S. Chand and Co. Ltd. New Delhi. West, E.S., Todd, W.R. Mason, S.M. and Van Bruggen, J.T. 1967. Text Book of Biochemistry, Mcmilan Co. New York. Wilson, K. and Walker, J (eds.). 1995. Practical Biochemistry- Principles and Techniques. Cambridge University Press. Online Resources

Course Code: 0512 08 AT 1210		Year: First	Term: Second
Course Title	Biochemistry Sessional		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is synchronized to qualitative and quantitative analysis of carbohydrate, protein and vitamin C along with various aspects of buffer solution, chromatography and spectrophotometry to provide substantial knowledge on the topics to the students.		
Course Objectives	To provide practical knowledge on identification and estimation of carbohydrate, protein and vitamin C along with the basics of chromatography and spectrophotometry.		

	Course Contents/Tasks	CLOs
1	Preparation of buffer solutions and determination of their pH.	1
2	Colour tests for proteins and carbohydrates.	2
3	Estimation of protein and starch of a plant sample.	3
4	Quantitative estimation of ascorbic acid in plant sample.	3
5	Paper chromatographic separation of amino acids and sugars.	4
6	GAS, column, TLC, HPLC, spectrophotometry.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Prepare buffer solution and determine pH.	9
	CLO2	Identify protein and CHO by color test.	9
	CLO3	Demonstrate the quantitative estimation of protein, vitamin C and starch from desired plant sample.	9
	CLO4	Display chromatographic and spectrophotometry techniques.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, video, demonstration in the lab	Formative (Quiz, active class participation, practical evaluation), summative
CLO2	Lecturing, discussion, video, demonstration in the lab	Formative (Quiz, active class participation, practical evaluation), summative
CLO3	Lecturing, discussion, video, demonstration in the lab	Formative (Quiz, active class participation, practical evaluation), summative
CLO4	Lecturing, discussion, video, demonstration in the lab	Formative (Quiz, active class participation, practical evaluation), summative

Learning Materials

Recommended Readings	Conn, E.E. and Stumpe, P.K. 1987. Outlines of Biochemistry, 5th ed. J. Wiley and Sons, New York. Goodwin, T. W. and Mercer, E. I. 2003. Introduction to Plant Biochemistry. CBS Publishers and Distributors. New Delhi, India. Jeremy, M. B., Tymoczko, J.L, and Stryer, L. 2002. Biochemistry. WH Freeman.
Supplementary Readings	Karet, R.L., Denniston, K.J. and Topping, J.J. 1997. Principles and Applications of Inorganic, Organic and Biological Chemistry. WCB, McGraw-Hill Kretovich, V.H., Nowarowski, T.Z. and Clarke, A.J. 1996. Principles of Plant Biochemistry. Pergamon Press. Oxford. London, New York. Paris. Krogmann, D.W. 1993. The Biochemistry of Green Plants. Prentice Hall of India Pvt. Ltd. New Delhi. Nelson, D. L. and Cox, M, M. 2007. Lehninger Principles of Biochemistry. WH Freeman and Company. Srivastava, L. L. 2004. Concepts of Biochemistry. CBS Publishers and Distributors. New Delhi, Bangalore. Verma, S.K. and Verma, M. 2012. A Text Book of Plant Physiology and Biochemistry. S. Chand and Co. Ltd. New Delhi. West, E.S., Todd, W.R. Mason, S.M. and Van Bruggen, J.T. 1967. Text Book of Biochemistry, Mcmilan Co. New York. Wilson, K. and Walker, J (eds.). 1995. Practical Biochemistry- Principles and Techniques. Cambridge University Press. Online Resources

Course Code: 0231 08 Eng 1251		Year: First	Term: Second
Course Title	Comprehension and Communications Skills in English		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	The course aims to enhance students' communicative competence and performance in English. It introduces to the students' topics related to pronunciation, vocabulary, syntax, and four basic skills of English.		

Course Contents		CLOs
Section A		
1	Introduction to English sounds and IPA: Use of a dictionary and development of English pronunciation; Development of vocabulary: processes of Word formation and transformation; Proper use of parts of speech.	1
2	Notion of a phrase and phrase structures: Sentence structure, structures of simple, complex, and compound sentences; Identification of clauses; Subject-verb agreement; Joining sentences; Transformation of sentences.	2
3	Reading skills: Perspectives on reading comprehension; Elements of reading: vocabulary, syntax and meaning; Reading strategies: intensive and extensive reading, scanning and skimming, prediction and inference, reader's expectation and interpretation, contextual understanding and understanding the whole text; effective note-taking.	3
Section B		CLOs
4	Listening and speaking skills: Elements of listening and speaking skills; Guidelines for developing listening skills; Art of good speaking; Speaker-listener rapport; Voice modulation, intonation, and stress; Expressing notions and functions; Body language, gesture, and posture; Practicing conversation.	1, 2
5	Writing skills: Understanding academic writing: features and elements; Mechanics of writing; Processes of writing: planning to write and generating ideas for a writing task, drafting and supporting ideas with evidence, integrating data and graphics in texts, revising, editing and finalizing the draft; ethics in writing.	2, 3
6	Writing tasks: Paragraph, essay, summary, précis, assignment, examination paper, report, abstract, letter of application, CV.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Pronounce English intelligibly.	1, 2
	CLO2	Produce grammatically correct sentences and accomplish writing tasks successfully in English.	1, 7
	CLO3	Comprehend a text effectively while reading it as well as orally communicate efficiently in English.	1, 6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, drill	Quiz and class test
CLO2	Lecture, drill, group work, presentation	Assignment and final exam
CLO3	Lecture, drill, group discussion, pair/group-work	Viva voce and final exam

Learning Materials

Recommended Readings	Eastwood, J. 1994. Oxford guide to English grammar. Oxford University Press. Jespersen, O. 2006. Essentials of English grammar. Routledge. Leech, G., and Svartvik, J. 2010. A communicative grammar of English. Longman. Quirk, R., and Greenbaum, S. 2000. A university grammar of English. Longman. Swan, M. 2006. Practical English usage. Oxford University Press.
Supplementary Readings	Craven, M. 2008. Real listening and speaking. Cambridge University Press. Day, T. 2013. Success in academic writing. Palgrave. Dunkel, P. and Pialorsi, F. 2005. Advanced listening comprehension: Developing aural and notetaking skills. Thomson. Gillett, A., Hammond, A. and Martala, M. 2009. Successful academic writing. Pearson Longman. Grellet, F. 1981. Developing reading skills: A practical guide to reading comprehension exercises. Cambridge University Press. Sowton, C. 2012. 50 Steps to improving your academic writing, reading. Garnet Publishing. Spears, Spears, D. M. 1998. Developing critical reading skills. McGraw-Hill College.

Course Code: 0613 08 CSE 1260		Year: First	Term: Second
Course Title	Word Processing and Spreadsheet Analysis		
Course Status	Optional		
Credit	1.5		
Prerequisite(s)	None		
Rationale	This course is designed to provide basic knowledge on computer, microsoft office and spreadsheet package.		

	Course Contents/Tasks	CLOs
1	Introduction to computer.	1
2	Detailed practice of word processing using contemporary word processing packages.	2
3	Spreadsheet analysis using contemporary spreadsheet packages.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Organize, calculate and analyze data into various types of logical format.	1, 3, 9
	CLO2	Combine all accounting and recording data in a document effectively.	2, 3, 9
	CLO3	Create budgets, produce graphs and charts, and for storing and sorting data.	2, 3, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, and team teaching	Quiz, assignment, active class participation, sudden test question, viva voce and final exam
CLO2	Lecturing, demonstration, group discussion, presentation	MCQ, presentation, assignment, active class participation, viva voce and final exam
CLO3	Lecturing, demonstration, group discussion, presentation, assignment	Quiz, short questions, MCQ, presentation, viva voce and final exam

Learning Materials

Recommended Readings	Glenn, H. M. 1980. Introduction to Computer system. McGraw Hill.
Supplementary Readings	Online resources

Second Year First Term			
Course Code: 0811 08 AT 2101		Year: Second	Term: First
Course Title	Fundamentals of Plant Pathology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is designed to describe the historical events of plant pathology and various plant diseases with special reference to their casual agents and symptoms.		

	Course Contents	CLOs
	Section A	
1	Introduction to plant pathology and its history: Introduction to Plant Pathology, brief history of plant pathology, significance of plant diseases with special reference to Bangladesh, causes of plant diseases, general symptoms of plant diseases.	1
2	Introduction to fungi: General characteristics of fungi including morphology, reproduction and nutrition, nomenclature and classification of fungi. Study of the following genera including their families and orders Achlya, Synchytrium, Pythium, Phytophthora, Peronospora, Albugo, Rhizopus, Saccharomyces, Penicillium, Aspergillus, Erysiphe, Claviceps, Puccinia, Ustilago, Agaricus. Detailed study of the orders, families, genera of deuteromycotina.	2
	Section B	CLOs
3	Introduction to bacteria: General morphology, reproduction and nutrition, classification and characteristics of plant pathogenic bacteria, types of bacterial diseases, ecology and spread, symptoms of bacterial diseases with examples, control of bacterial diseases of plants.	2
4	Introduction to plant viruses and mycoplasmas: Characteristics of plant viruses; physical and chemical structures; transmission, identification and classification of viruses; symptoms caused by plant viruses, control of viral diseases; viroids, mycoplasmas and other ultra-microscopic organisms.	2
5	Introduction to plant parasitic nematodes: Morphology, anatomy, physiology, feeding mechanism and reproduction; classification of plant parasite nematodes; symptoms of nemic diseases with examples. Control of nemicdiseseses.	2
6	Plant diseases caused by parasitic phanerogams: Definition, classification, description of important phenerogamic parasites.	3

		Upon successful completion of the course, the students will be able to:	Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	State causes and important symptoms of plant diseases.	1, 2, 3
	CLO2	Illustrate and Identify plant pathogenic fungi, bacteria, viruses and nematodes.	1, 2, 3
	CLO3	Classify phanerogamic parasites and their control measures.	1, 2, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, historical discussion, pictorial presentation, photograph based studyand team teaching	Quiz, assignment, active class participation, sudden test question and class test, viva voce and final exam
CLO2	Lecturing, graph and pictorial discussion, group discussion, video, assignment, presentation, field visit for problem-based learning and give prescription	Quiz, short questions, MCQ, presentation, assignment, active class participation, sudden class test, question-answering, viva voce and final exam
CLO3	Group discussion, presentation, debate, assignment	Quiz, short questions, MCQ, presentation, viva voce and final exam

Learning Materials

Recommended Readings	Agrios, G.N. 2012. Plant Pathology. 5th ed. Academic press, New York. Alexopoulos, C. J., Mims, C. W. and Blackwell, M. 1996. Introductory Mycology. 4th ed. John wiley and sons. Inc. New York. Asrafuzzaman, H. 1991. A Text Book of Plant Pathology. 4th ed. Bangladesh Agricultural Research Council, Dhaka. Boss, L. 1983. Introduction to Plant Virolology. Centre for Agricultural Publishing and Documentation, Wagenigen, Netherlands. Dube, H.C. 1990. An Introduction to Fungi. 2nd ed. Vikas publishing house pvt. Ltd. New Delhi.
Supplementary Readings	Singh, R.S. 2017. Introduction to Principles of Plant Pathology. 4th ed., CBS Publishers & Distributors, India. Vashista, B. R. 1992. Botany for Degree Students' Fungi. S. Chand and company, New Delhi. Verma, H.K. 2012. A text book of fungi. Random Publications. New Delhi. Mehrotra, R.S. and Aneja, K R. 1990. An Introduction to Mycology. New age international publishers. Mian, I.H. 1996. Introduction to Nematology. 2nd ed. Institute of Postgraduate Studies in Agriculture, Gazipur, Bangladesh. Nene, Y.L. and Thapliyal, P. N. 1993. Fungicides in Plant Disease Control. 3rd ed. Oxford and IBH publishing co. pvt. Ltd. Singh, R.S. 1990. Plant Disease. 7th ed. Oxford and IBH publishing co. pvt. Ltd. New Delhi.

Course Code: 0811 08 AT 2102		Year: Second	Term: First
Course Title	Fundamentals of Plant Pathology Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is oriented to provide handling of laboratory equipment's and techniques related to identification and characterization of important fungi, nematode and phanerogamic parasites.		

	Course Contents/Tasks	CLOs
1	Cleaning of glassware and laboratory instruments.	1
2	The microscopy: care and handling of light microscope.	1, 2
3	Preparation and observation of microscopic slides.	2
4	Methods of sterilization.	3
5	Preparation of culture media.	3
6	Isolation and identification of nematodes from diseased plant materials and soil.	4
7	Study of the following fungi: Pythium, Rhizopus, Aspergillus, Penicillum, Agaricus, Curvularia, Fusarium, Rhizoctonia, Sclerotium. Phanerogamic parasites (Cuscuta, Loranthus, Striga and Orobanche).	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Use and care different instruments of plant pathology laboratory.	1, 2, 3, 9
	CLO2	Prepare slides for microscopic observation.	1, 2, 3, 9
	CLO3	Prepare and sterilized culture media and laboratory instruments.	1, 2, 3, 9
	CLO4	Isolate and characterized plant pathogens from diseased plant materials and soil.	4, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, video, pictorial presentation, photograph based studyand demonstration	Quiz, assignment, active class participation, test question and viva voce and final exam
CLO2	Lecturing Video for case study, individual assignment, demonstration, disease sample study	Quiz, active class participation, quiz, MCQ, question-answering, viva voce and final exam
CLO3	Lecturing Video for case study, individual assignment, demonstration	Quiz, active class participation, quiz, MCQ, question-answering, viva voce and final exam
CLO4	Demonstration, Identification of plant pathogens, group discussion, specific disease case study	Quiz, active class participation, quiz, MCQ, question-answering, viva voce and final exam

Learning Materials

Recommended Readings	Agrios, G.N. 2012. Plant Pathology. 5th ed. Academic press, New York. Alexopoulos, C. J., Mims, C. W. and Blackwell, M. 1996. Introductory Mycology. 4th ed. John wiley and sons. Inc. New York. Asrafuzzaman, H. 1991. A Text Book of Plant Pathology. 4th ed. Bangladesh Agricultural Research Council, Dhaka. Barnett, H. L. and Hunter, B. B. 1972. Illustrated genera of imperfect fungi. 3rd ed. Burgess publishing company, USA.
Supplementary Readings	Singh, R.S. 2017. Introduction to Principles of Plant Pathology. 4th ed., CBS Publishers & Distributors, India. Vashista, B. R. 1992. Botany for Degree Students' Fungi. S. Chand and company, New Delhi. Verma. H.K. 2012. A text book of fungi. Random Publications. New Delhi. Dhingra, O. D. and Sinclair, J. B. 1995. Basic Plant pathology methods, 2nd. ed. Lewis publishers is an imprint of CRC press. Mian, I.H. 1996. Introduction to Nematology. 2nd ed. Institute of Postgraduate Studies in Agriculture, Gazipur, Bangladesh.

Course Code: 0811 08 AT 2103		Year: Second	Term: First
Course Title	Plant Physiology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is designed to introduce different physiological processes in relation to plant growth and development		

	Course Contents	CLOs
	Section A	
1	Introduction and scope of plant physiology.	1
2	Absorption of water and mineral nutrients: Water relations- water potential, diffusion, osmosis, plasmolysis and imbibition; concept and theories of water absorption; ascent of sap- concept and theories; absorption of mineral nutrients- mechanism and theories.	1, 2
3	Transpiration: Types, mechanisms and theories; factors affecting transpiration and significance of transpiration.	1
4	Photosynthesis: Photosynthetic apparatus and pigment systems; light reaction - two pigment systems, photophosphorylation, energy relations and photosynthetic efficiency; dark reactions - C3, C4 and CAM pathways; factors influencing photosynthesis; role of photosynthesis.	1
5	Translocation: Concept, types of translocation, source – sink relationship and partitioning of assimilates in plant.	1
6	Respiration: Definition, significance, types, respiratory substrates, respiratory quotient; aerobic and anaerobic respiration- glycolysis, Kreb's cycle, hexose monophosphate shunt (HMP); oxidation; electron transport system; factors affecting respiration; energetics in relation to respiration; photorespiration.	2
	Section B	CLOs
7	Plant growth and plant growth regulators: Growth concept, types, phases of growth, plant growth analysis; characteristics and classification of plant growth regulators, plant growth regulators vs phytohormones; effect of hormones on growth and development of plants; uses of hormones in agriculture.	3
8	Photoperiodism: Concept, critical photoperiod, photoperiodic classification of plants; mechanism of flowering and its role.	3
9	Vernalization: Concept, processes and factors of vernalization, its application in agriculture.	4
10	Physiology of seed and bud: Concept, types, causes and breaking of dormancy, testing of viability and physiology of seed germination.	4
11	Stress physiology: Stresses (water, salinity and temperature) in plants and their effects on physiology with mitigation to crop losses.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain the mechanism of water and nutrient absorption, photosynthesis, transpiration and respiration in relation to plant growth.	1, 2, 3
	CLO2	Describe the role of plant growth regulators and flowering mechanism in plants.	1
	CLO3	Narrate the mechanism of seed dormancy, germination, viability and vigor.	1, 3, 11
	CLO4	Describe the impact of stress on plant growth and development.	3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Quiz, objectives, active class participation, assignment) and summative (Term final)
CLO2	Lecture, presentation	Continuous (Formative: Objectives, active class participation) and summative (Term final)
CLO3	Lecture, group discussion, video	Continuous (Formative: Viva, presentation) and summative (Term final)
CLO4	Lecture and field visit	Continuous (Formative: Assignment, active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Taiz, L. and Zeiger, E. 2010. Plant Physiology, 5th ed. Sinauer Associates Inc., Publishers, Sunderland, Massachusetts, USA. Evans, L.T. 1975. Crop Physiology. Cambridge Univ. Press, Cambridge.
Supplementary Readings	Jain, V. K. 2011. Fundamentals of Plant Physiology. 13th ed. S. Chand & Company Ltd. New Delhi, India. Levitt, J. 1972. Response of Plants to Environmental Stress. Acad Press. New York. Journal of Plant Physiology. Journal of Plant Physiology and Biochemistry.

Course Code: 0811 08 AT 2104		Year: Second	Term: First
Course Title	Plant Physiology Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is provided to introduce different physiological process and analysis in relation to plant growth and development.		

	Course Contents/Tasks	CLOs
1	Studies on absorption, transpiration, plasmolysis, photosynthesis and respiration.	1
2	Extraction of leaf pigments.	2
3	Demonstration on the effect of important phytohormones.	3
4	Effect of light intensity on the rate of photosynthesis.	3
5	Separation of carbohydrate and amino acid by paper chromatography.	3
6	Determination of crop growth rate (CGR), leaf area index (LAI), and harvest index (HI).	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Determine different physiological process for optimum plant growth.	1, 2
	CLO2	Demonstrate carbohydrate and leaf pigment separation and identification process.	1
	CLO3	Compare the role of phytohormone and light intensity on plant growth and development.	1, 2
	CLO4	Measure crop growth parameters, harvest index.	10, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Field visit and case study	Report writing, demonstration

Learning Materials

Recommended Readings	Taiz, L. and Zeiger, E. 2010. Plant Physiology, 5th ed. Sinauer Associates Inc., Publishers, Sunderland, Massachusetts, USA. Evans, L.T. 1975. Crop Physiology. Cambridge Univ. Press, Cambridge.
Supplementary Readings	Jain, V. K. 2011. Fundamentals of Plant Physiology. 13th ed. S. Chand & Company Ltd. New Delhi, India. Levitt, J. 1972. Response of Plants to Environmental Stress. Acad Press. New York. Journal articles Internet

Course Code: 0811 08 AT 2105		Year: Second	Term: First
Course Title	Agrometeorology and Environmental Impacts		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is schemed to stretch detail information about climatic factors and their influence on crops as well as environment.		

	Course Contents	CLOs
	Section A	
1	Introduction: Definition and scope of meteorology; importance of meteorology on agriculture; climatic factors affecting agricultural production.	1
2	Clouds: Forms and classification of clouds.	2
3	Weather and climate: Concept; atmosphere and its vertical structure; fronts and cyclones; tides and its effects; thunderstorms, hail and tornadoes; the climate and the weather of Bangladesh.	2
4	Temperature: Terminology, lapse rates, cardinal temperatures; measurement of temperature; radiative index of dryness, growing degree days.	2
5	Humidity: Terminology, properties of water vapour.	2
6	Wind: Definition and measurement; geographic and time variation of winds.	2
7	Precipitation: Forms, types and measurement; measurement of humidity.	2
	Section B	CLOs
8	Solar radiation: Radiation through the atmosphere; radiation and energy balances at the earth surface; green house effect.	2
9	Carbon dioxide balance: Introduction, carbon dioxide concentration pattern; carbon dioxide balance of a growing crop.	3
10	Photosynthesis: Net assimilation of carbon dioxide; photosynthesis and water use efficiency.	3
11	Improving water use efficiency: Antitranspirants, reflectants, carbon dioxide enrichment.	4
12	Weather forecasting: Methods of weather prediction; predictability of the weather; accuracy of weather forecasts; special forecasts.	5
13	Crop forecasting: Crop forecasting based on agrometeorological data; utilization of meteorological data in production planning.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain climatic factors and their influence on agricultural production.	1, 2, 4
	CLO2	Summarize cloud, hail, cyclone, fronts, tides, thunderstorm, temperature, humidity, wind, precipitation and solar radiation.	1, 2, 4
	CLO3	Relate CO_2 concentration with photosynthesis and greenhouse effect.	1, 2, 3, 4
	CLO4	Formulate guidelines to improve WUE.	1, 2, 3, 4, 11
	CLO5	Analyze weather and crop forecasting.	1, 2, 3, 4, 11, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion	Continuous assessment (Formative: Quiz, active class participation) and summative (Term final)
CLO2	Lecturing, discussion, video presentation	Continuous assessment (Formative: Quiz, active class participation, calculation, question-answering) and summative (Term final)
CLO3	Lecturing, video, field visit, debate, demonstration	Continuous assessment (Formative: Assignment, MCQ, presentation) and summative (term final)
CLO4	Lecturing, presentation, farm visit, video	Continuous assessment (Formative: Objective, presentation) and summative (Term final)
CLO5	Lecturing, field visit, presentation	Continuous assessment (Formative: Objectives, quiz, question-answering, MCQ) and summative (Term final)

Learning Materials

Recommended Readings	Henderson-Sellers, A. and Robinson, P. J. 1988. Contemporary Climatology. ELBS. Longman Group (FE) Ltd. UK. Houghton, J. T. 1979. The Physics of Atmospheres. Cambridge University Press, UK. Linacre, E. 1992. Climate Data and Resources. A reference and guide. Routledge. Landon UK. Marvin E. J. (ed.) 1974. Consumptive Use of Water and Irrigation Water Requirements. American Society of Civil Engineers, New York. Mavi, H.S., 1994. Introduction to Agrometeorology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
Supplementary Readings	Menteith. J. L. 1980. Principles of Environmental Physics. WhitstableLitho Ltd. Whitstable, Kent, UK. Neiburger, M., Edinger, J.G. and William, D. B. 1973. Understanding Our Atmospheric Environment. W.H. Freeman and Company, San Francisco. Petterssen, S. 1969. Introduction to Meteorology, 3rd ed. McGraw-Hill Book Company, New York. Pierre, W. H., Kirkham, D., Pesek, J. and Shaw, R. 1981. Plant Environment and Efficient Water Use. American Society of Agronomy and Soil Science. Wisconsin, USA. Rosenberg, N. J. 1974. Microclimate: The Biological Environment. John Woley & Sons, New York. Yoshino, M. M. 1975. Climate in a Small Area-An Introduction to Local Meteorology. University of Tokyo.

Course Code: 0811 08 AT 2106		Year: Second	Term: First
Course Title	Agrometeorology and Environmental Impacts Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide practical knowledge on meteorological factors and analysis of climatic data. The course also emphasizes on the climatic hazards on crops.		

	Course Contents/Tasks	CLOs
1	Identification of clouds.	1
2	Problems on temperature, humidity, wind velocity, evapo-transpiration and precipitation.	2
3	Collection and presentation of weather and climatic data.	3
4	Field identification of crop damage due climatic disturbance.	5
5	Survey on instrumentation of a meteorological station and report writing.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify different types of clouds.	1, 2, 9, 10
	CLO2	Solve problems related to elements of weather.	1, 2, 3, 9, 10
	CLO3	Collect and interpret weather and climatic information.	1, 2, 9, 10
	CLO4	Value meteorological instruments.	1, 5, 7, 8, 9, 11
	CLO5	Determine the harmful effect of weather elements.	1, 2, 3, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, farm visit, demonstration	Sessional assessment (Formative: Identification and summative)
CLO2	Lecturing, laboratory work, demonstration, field visit	Sessional assessment (Formative: Problem solving, laboratory study, and viva)
CLO3	Lecturing, field visit, group work	Sessional assessment (Formative: Laboratory study, problem solvingand viva)
CLO4	Video, demonstration, pair work, case study	Sessional assessment (Formative: Laboratory study, problem solving and viva)
CLO5	Video, demonstration, field visit, case study	Sessional assessment (Formative: Report, presentation and viva)

Learning Materials

Recommended Readings	Henderson-Sellers, A. and Robinson, P. J. 1988. Contemporary Climatology. ELBS. Longman Group (FE) Ltd. UK. Houghton, J. T. 1979. The Physics of Atmospheres. Cambridge University Press, UK. Linacre, E. 1992. Climate Data and Resources. A reference and guide. Routledge. Landon UK. Marvin E. J.(ed.) 1973. Consumptive Use of Water and Irrigation Water Requirements. American Society of Civil Engineers, New York. Mavi, H. S. 1994. Introduction to Agrometeorology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
Supplementary Readings	Menteith. J. L. 1980. Principles of Environmental Physics. WhitstableLitho Ltd. Whitstable, Kent, UK. Neiburger, M., Edinger, J. G. and William D. B. 1973. Understanding Our Atmospheric Environment. W.H. Freeman and Company, San Francisco. Petterssen, S. 1969. Introduction to Meteorology, 3rd ed. McGraw-Hill Book Company, New York. Pierre, W. H., Kirkham, D., Pesek, J. and Shaw, R. 1981. Plant Environment and Efficient Water Use. American Society of Agronomy and Soil Science. Wisconsin, USA. Rosenberg, N. J. 1974. Microclimate: The Biological Environment. John Woley & Sons, New York. Yoshino, M. M. 1975. Climate in a Small Area-An Introduction to Local Meteorology. University of Tokyo.

Course Code: 0811 08 AT 2107		Year: Second	Term: First
Course Title	Ornamental Horticulture		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The students will be taught different aspects of cultivation and management of ornamental crops to capable them for planning and designing healthy environment.		
Course Objectives	To equip the students with the knowledge on ornamental plants and their use in beautifying the surroundings.		

	Course Contents	CLOs
	Section A	
1	Introduction: Ornamental horticulture; scope and importance of growing ornamental plants in Bangladesh; prospect of floriculture in domestic and export market.	1
2	Systematic ornamental horticulture: Classification, nomenclature and ecological distribution of ornamental plants.	1
3	Production and management of bedding flowers: Zinnia, cosmos, calendula, globe amaranth, phlox, antirrhinum, dianthus, balsam, corn flower and lupine.	2
4	Production and management of commercial flowers: Rose, dahlia, chrysanthemum, carnation, tuberose, gladiolus, marigold, jasmine, lilies, orchids, ferns and cacti.	2
	Section B	CLOs
5	Landscape horticulture: Landscape horticulture; basic principles of landscape design; components of landscape design; importance and scope of landscape gardening.	3
6	Landscape planning for different places: City avenues, historical buildings and ruins, homesteads, institutions, railway stations and tracks, dam sites, canal sites and riverbanks. Development and maintenance of lawn, turf, shrubbery, topiary, water garden, rock garden, Mughal garden, Japanese garden and the English garden.	3, 4
7	Special techniques in ornamental horticulture: Bonsai, floral ornaments and flower arrangements; indoor culture.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify, classify ornamental plants and explore problems and prospects of ornamental horticulture.	1, 2, 3
	CLO2	Discuss production and management practices for bedding and commercial flowers.	1, 5
	CLO3	Develop landscape planning for different places.	1, 2, 3
	CLO4	Plan and manage lawn, turf, topiary and different types of gardens.	1, 9
	CLO5	Explain and utilize bonsai, floral arrangements and indoor horticulture.	1, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, video, demonstration, field visit	Formative (Quiz, assignment, objectives, active class participation), summative
CLO2	Lecturing, demonstration, field visit, group discussion, report writing	Formative (Objectives, quiz, question-answering, presentation), summative
CLO3	Group discussion, demonstration, presentation, case study	Formative (Objectives, quiz, short questions, MCQ, presentation), summative
CLO4	Group discussion, demonstration, presentation, case study, debate, assignment	Formative (Viva, quiz, short questions, MCQ, presentation), summative
CLO5	Lecturing, demonstration, field visit, group discussion, report writing	Formative (Objectives, quiz, short questions, MCQ, presentation), summative

Learning Materials

Recommended Readings	Abraham, H. 1985. Hand Book of Flowering (Vol. I-V), CRC Press, Inc..Boea Raton, Florida. Royal Horticulture Society. 1999. Encyclopedia of Plants and Flowers. Bhattacharjee, S. K. 2012. Landscape Gardening and Design with Plants. Aavishkar Pub. India. Bose, T. K. 2002. Floriculture and Landscaping. Nada Udyog. Bose, T. K. and Yadav, L. P. 1989. Commercial Flowers, Naya Prakash, Calcutta, India.
Supplementary Readings	Coutts, J. and Preston, G. H. 1966. All About Gardening, Ward, Lock and Co. Pvt. Ltd. London. Dey, S. C. 2012 Indore Gardening. Agrobios, India. Dey, S. C. 2003. Flowers from Bulbous Plants. Agrobios, India. Grindal, E. W. 1960. Everyday Gardening in India. Taraporevala Sons and Co. Pvt. Ltd. Bombay. Hessayon, D. G. 1988. The Rose Expert, Pbi Publications, Britannica House, England. Hessayon, D. G. 1994. The Flowering Shrub Expert, Transworld Publishers Ltd.London. Prasad, S. and Kumar, U. 1998. Commercial Floriculture. Agrobios, India. Quiros, A. and Barbara, L. Y. 1977. The World Book of Cactus and Succulents, Ortho Book Publishers, San Ramon, USA. Randhawa, G. S. 1973, Ornamental Jorticulture in India. Today and Tomorrow's Printers. Randhawa, M. S. 1974. Flowering Trees. National Book Trust. India. Shewell-Cooper, W. E, 1976, Basic Book of Flower Gardening, Barrie and Jenkins Ltd. London. Online Resources

Course Code: 0811 08 AT 2108		Year: Second	Term: First
Course Title	Ornamental Horticulture Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course includes identification, cultivation, pruning, training, cost-benefit analysis and relevant issues of ornamental crops to develop practical knowledge of students on these topics.		
Course Objectives	To familiarize the students with different perspectives of ornamental horticulture including modeling and designing landscapes.		

	Course Contents/Tasks	CLOs
1	Identification of different flowers, ornamental plants, cacti, ferns and orchids.	1
2	Modeling of home and institutional gardens.	3
3	Graphic design of park, rock garden, water garden and roadside plantations.	3
4	Pruning and training of flowering and ornamental plants.	2
5	Cost benefits analysis of important commercial flowers.	2
6	Visit to important places having significant landscape values.	4
7	Cultivation of ornamental plants in individual plots.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify various ornamental plants.	1, 2
	CLO2	Practice cultivation, pruning and training, cost-benefit analysis of ornamental plants.	1, 2, 5, 9
	CLO3	Design Park, rock garden, water garden, road side plantations and prepare models for these.	2, 3
	CLO4	Gain practical knowledge through visiting places with significant landscape values.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, video, demonstration, discussion	Formative (Quiz, performance evaluation, active class participation), summative
CLO2	Demonstration, discussion, presentation, video	Formative (Objectives, question-answering, performance evaluation), summative
CLO3	Lecturing, video, demonstration, discussion	Formative (Quiz, performance evaluation, active class participation), summative
CLO4	Field visit, discussion	Formative (Viva, report evaluation), summative

Learning Materials

Recommended Readings	Abraham, H. 1985. Hand Book of Flowering (Vol. I-V), CRC Press, Inc..Boea Raton, Florida. Royal Horticulture Society. 1999. Encyclopedia of Plants and Flowers. Bhattacharjee, S. K. 2012. Landscape Gardening and Design with Plants. Aavishkar Pub. India. Bose, T. K. 2002. Floriculture and Landscaping. Nada Udyog. Bose, T. K. and Yadav, L. P. 1989. Commercial Flowers, Naya Prakash, Calcutta, India.
Supplementary Readings	Coutts, J. and Preston, G. H. 1966. All About Gardening, Ward, Lock and Co. Pvt. Ltd. London. Dey, S. C. 2012 Indore Gardening. Agrobios, India. Dey, S. C. 2003. Flowers from Bulbous Plants. Agrobios, India. Grindal, E. W. 1960. Everyday Gardening in India. Taraporevala Sons and Co. Pvt. Ltd. Bombay. Hessayon, D. G. 1988. The Rose Expert, Pbi Publications, Britannica House, England. Hessayon, D. G. 1994. The Flowering Shrub Expert, Transworld Publishers Ltd.London. Prasad, S. and Kumar, U. 1998. Commercial Floriculture. Agrobios, India. Quiros, A. and Barbara, L. Y. 1977. The World Book of Cactus and Succulents, Ortho Book Publishers, San Ramon, USA. Randhawa, G. S. 1973, Ornamental Jorticulture in India. Today and Tomorrow's Printers. Randhawa, M. S. 1974. Flowering Trees. National Book Trust. India. Shewell-Cooper, W. E, 1976, Basic Book of Flower Gardening, Barrie and Jenkins Ltd. London. Online Resources

Course Code: 0811 08 AT 2109		Year: Second	Term: First
Course Title	Cattle and Poultry Farming		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course is oriented to provide students the technology of successful farming operation for cattle and poultry		
Course Objectives	To teach the learners practically about different aspects of cattle and poultry farming To generate the skills of the students in the field of cattle and poultry farming		

	Course Contents	CLOs
	Section A	
1	Dairy cattle production: Care of newborn calves, feeding of colostrums, care and management of milking cows; factors affecting the quality and quantity of milk. Management practices of dairy farm-routine work, hygiene basic, cleaning, disinfection and sanitation of dairy farm. Composition and food value of milk.	1, 2
2	Beef fattening: Selection of animal for fattening, urea molasses straw preparation and its application.	4
3	Housing livestock: Definition and objectives of housing, different types of houses and sheds in ideal dairy farms.	1, 7
4	Feeding livestock: Definition of ration and balanced ration, characteristics of good ration, factors considered during ration formulation, formulation of ration for dairy cattle.	5
5	Artificial insemination: Definition, history, merits and demerits of artificial insemination, proper heat detection in dairy cows and artificial insemination for crossbreeding.	6
6	Farm planning: Planning of a dairy farm- factors affecting gross margin in dairy farm, preparation of dairy projects containing technical, economical, commercial and financial aspects.	5, 7
	Section B	CLOs
7	Management of commercial layers: Duties and responsibilities of farm manager; different types of houses used for layers; floor space and cage density; description of equipment used in layer house; moulting and its effects on egg production.	1
8	Egg: Definition, use, chemical composition, food value and grading of eggs. Incubation of eggs, selection and care of hatching eggs, requisite for successful incubation, factors affecting fertility and hatchability of eggs.	3
9	Broiler flock management: Characteristics of different strains available in Bangladesh; requirements for successful broiler production.	1
10	Farm planning: Planning of a poultry farm; cost benefit analysis of different sizes of layers and broiler farms.	5, 7

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Discuss care and management of dairy cattle and poultry.	1
	CLO2	Narrate the factors affecting the quality and quantity of milk.	1, 2
	CLO3	Explain production technology and food value of eggs.	4
	CLO4	Gain skill on cattle fattening.	4
	CLO5	Formulate balanced rations for dairy cattle and poultry.	10
	CLO6	Acquainted the techniques of proper breeding and artificial insemination in cattle and poultry.	9
	CLO7	Plan a dairy and poultry project.	10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecture and team teaching	Quiz and class test
CLO5	Problem-based learning and presentation	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation

Learning Materials

Recommended Readings	Atherton, H.V. and Newlander, J.A. 2004. Chemistry and testing of dairy Products. 4th ed., CBS Publishers and Distributors, New Delhi. Chauhan, H.V.S. and S. Roy. 2010. Poultry Diseases Diagnosis and Treatment. 3rd ed., New Age International Publishers, New Delhi. Engineering India Research Institute (EIRI). 2012. Hand Book of Dairy farming to Produce Milk with Packaging. Mahindru, S.N. 2009. Milk and Milk Products. A P H Publishing Corporation, New Delhi.
Supplementary Readings	Mountney, G.J. and C.R. Parkhurst. 2001. Poultry Products Technology, 3rd ed., Food Products Press, An Imprint of the Haworth Press, Inc. Neshiem, M. C., Austic, R. E. and Card, L. E. 1979. Poultry Production, 12th ed., Lea and Febiger, Philadelphia, USA. Prasad, J. and Neeraj. 2010. Principles and Practices of Dairy Farm Management. 6th Ed., Kalyani Publishers, New Delhi. Sethumadhavan, T.P. 2004. Sustainable Dairy Farming: An Overview. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. Sharma, H., Pandey, H. and Singh, C. 2009. Objective Questions in Dairy Science and Technology and Food and Dairy Engineering. CBS Publishers and Distributors Pvt. Ltd. New Delhi. Srivastava, S.M. 1998. Milk and Its Properties. Kalyani Publishers, New Delhi.

Course Code: 081108 AT 2110		Year: Second	Term: First
Course Title	Cattle and Poultry Farming Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is oriented to provide students applied knowledge on cattle and poultry farming. The purpose is to apply the practical knowledge for cattle and poultry farming.		
Course Objectives	To prepare a student to establish and operation of dairy and poultry farms.		

	Course Contents/Tasks	CLOs
1	Cattle practice in the use of dairy records; methods of administering of drugs; techniques of vaccination of dairy cattle; demonstration of routine livestock farm operations; visit to dairy farms.	1, 2, 3, 5
2	Poultry preparation of brooder; grower, layer and broiler houses; placement of equipment and their operation in the brooder and layer houses; ration formulation; demonstration of routine poultry farm operations; visit to poultry farms.	3, 4, 5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Operate dairy and poultry farms.	1, 9
	CLO2	Keep dairy and poultry farm's records.	9
	CLO3	Apply drugs and vaccines to farm animals and poultry.	8
	CLO4	Prepare brooder, grower, layer and broiler houses.	4, 8
	CLO5	Formulate rations for different types of cattle and poultry.	10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam
CLO5	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam

Learning Materials

Recommended Readings	Agricultural Research Council (ARC). 1990. The Nutrient Requirements of Ruminant Livestock. Commonwealth Agricultural Bureaux, Slough, England. Atherton, H.V. and Newlander, J.A. 2004. Chemistry and Testing of Dairy Products. 4th ed., CBS Publishers and Distributors, New Delhi. Chauhan, H.V.S. and Roy, S. 2010. Poultry Diseases Diagnosis and Treatment. 3rd ed., New Age International Publishers, New Delhi. Davis, R.F. 1965. Modern Dairy Cattle Management. Prentic Hall Inc. EngleweedChiffs, N.J., USA. Engineering India Research Institute (EIRI). 2012. Hand Book of Dairy farming to Produce Milk with Packaging.
Supplementary Readings	Neshiem, M. C., Austic, R. E. and Card, L. E. 1979. Poultry Production. 12th ed., Lea and Febiger, Philadelphia, USA. Neeraj, J. P. 2010. Principles and Practices of Dairy Farm Management. 6th ed., Kalyani Publishers, New Delhi. Sethumadhavan, T.P. 2004. Sustainable Dairy Farming: An Overview. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. Sharma, H., H. Pandey, and C. Singh. 2009. Objective Questions in Dairy Science and Technology and Food and Dairy Engineering. CBS Publishers and Distributors Pvt. Ltd. New Delhi. Srivastava, S.M. 1998. Milk and Its Properties. Kalyani Publishers, New Delhi. Garnsworthy, P.C. 1988. Nutrition and Lactation in the Dairy cow. Butterworths, Kent, England. Mahindru, S.N. 2009. Milk and Milk Products. A P H Publishing Corporation, New Delhi. Mountney, G.J. and Parkhurst, C.R. 2001. Poultry Products Technology. 3rd ed., Food Products Press.

Course Code: 0811 08 URP 2154	Year: Second	Term: First
Course Title	GIS Sessional - I	
Course Status	Optional	
Credit	1.5	
Prerequisite(s)	None	
Rationale	This course is designed to provide basic knowledge on GIS and GIS application.	

	Course Contents/Tasks	CLOs
1	Definition, terminology in GIS, vector and raster GIS, GIS database creation: Map digitizing, editing, topology, linking database with maps, GIS map presentation.	1
2	GIS application: Agriculture information management, development and handling of multi-layers agriculture information of the same area, site selection of the study area.	2

		Upon successful completion of the course, the students will be able to:	Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Understand the database system in GIS.	1, 3
	CLO2	Use GIS in agriculture.	1, 2, 7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration	Continuous (Formative: Viva, active class participation) and summative (Term final)
CLO2	Lecture, demonstration	Continuous (Formative: Viva, active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Bonham-carter, G. F. 1994. Geographical Information System for Geoscientists- Modeling with GIS, Pergamon.
Supplementary Readings	Burrough, P. A. 1986. Principles of Geographical Information System for Land Resources Assessment. Clarendo Press.

Course Code: 0811 08 Econ 2155		Year: Second	Term: First
Course Title	Agricultural Economics		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide knowledge on basics of agricultural economics, demand-supply, consumer behavior, agricultural finance, farm management, agricultural marketing and land tenure system.		

Course Contents		CLOs
	Section A	
1	Introduction: Definition and scope of economics and agricultural economics; scarcity, commodity, production, distribution, consumption; solution of basic economic problems; Production Possibility Curve.	1, 2
2	Demand and supply: Concept of demand and supply, law of demand and supply, determinants of demand and supply; demand and supply functions, equations, schedules and curves; market equilibrium.	2, 3
3	Theory of production: Factors of production; production function; stages of production; returns to scale; iso-quant and iso-cost curve; producer's equilibrium; cost and revenue; market structure.	2, 3
4	Introduction to macroeconomics and Bangladesh economy: Basic macroeconomic concepts- GNP, GDP, NNP, NI, PI, DI; methods of measuring national income; overview of the economy of Bangladesh; major sectors of the economy and their contributing to national income.	1
	Section B	CLOs
5	Agricultural finance: Definition of money, value of money and inflation, sources of capital and credit; nature and role of rural money market; impact of informal credit system on agriculture; indebtedness and rural poverty in Bangladesh; central bank, commercial banks and specialized banks and their functions.	4
6	Agriculture and economic development: Role of agriculture in the economic development of Bangladesh; characteristics of Bangladesh agriculture; problems of agricultural development in Bangladesh; traditional agriculture and modern agriculture; farmer's role as a decision-maker.	1, 4, 5
7	Farm and farm size: Subsistence, commercial, specialized and diversified farms; private, cooperative and collective farms.	5
8	Land tenure and land reform: Role of land tenure in agriculture; owner operator, sharecropper; land reforms in Bangladesh.	5
9	Agricultural marketing: market structure; Agricultural marketing-cost, marginal, efficiency, intelligence, grading, integration; imperfections in agricultural marketing in LDCs.	4, 5

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Gather basic knowledge about economics and agricultural economics and economy of Bangladesh.	1
	CLO2	Understand how demand and supply creates market equilibrium and the factors responsible for changing goods and products markets.	1, 7
	CLO3	Apply knowledge of how agricultural products matures according to its different stages of production and its pricing decision based on different market structure.	1
	CLO4	Recognize the characteristics and problems embedded in Bangladesh agriculture and importance of financing and credit for profit maximization in agriculture.	1, 3, 6
	CLO5	Grasp the importance of farm size, land tenure for agriculture and its resultant impact on economic development.	1

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, demonstration	Continuous (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO2	Lecturing, video, demonstration	Continuous (Formative: Quiz, assignment, objectives, active class participation) and summative (Term final)
CLO3	Lecturing, demonstration	Continuous (Formative: Objectives, quiz, question-answering, presentation) and summative (Term final)
CLO4	Group discussion, demonstration, presentation, case study	Continuous (Formative: Objectives, quiz, short questions, MCQ, presentation) and summative (Term final)
CLO5	Lecture, case study, group discussion, presentation, debate, demonstration	Continuous (Formative: Objectives, quiz, question-answering, presentation) and summative (Term final)

Learning Materials

Recommended Readings	Barkley, P. W. and Barkley, A. 2016. Principles of Agricultural Economics, 2nd ed. Routledge. Mankiw, N. G. 2014. Principles of Economics, 7th ed., Worth Publication; New York. Parkin, M. 2003. Macroeconomics, 10th ed., Pearson Education Limited: New York.
Supplementary Readings	Salvatore, D. 2011. Theory and Problems of Macroeconoics Theory, 4th ed., McGraw-Hill Inc.; New York. Samuelson, P. A. and Nordhaus, W. 2005. Economics, 18th ed., Tata McGraw-Hill: New Delhi. Sloman, J. 2006. Economics, 6th ed., Pearson Education Ltd., Essex. Stiglitz, J. E. 2006. Principles of Micro Economics, 4th ed., W.W. Norton and Company Ltd., London.

Course Code: 0721 08 FT 2157		Year: Second	Term: First
Course Title	Food Technology		
Course Status	Optional		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course is designed to understand the fundamental concepts of different food items, their composition and nutritional values for human.		
Course Objectives	To discuss the basic concepts of foods and their nutritional values. To offer students with foundation knowledge of nutrients requirements and its deficiency symptoms in human.		

	Course Contents	CLOs
	Section A	
1	Introduction: Definitions of food and nutrients, principal components of foods, functions of foods, classification of foods, properties of foods: physical, chemical and functional properties.	1
2	Vegetables, fruits and pulses: Varieties of pulses & grams, composition, nutritive value, cooking quality of pulses, germination and its effect. Vegetables - Classification, composition, nutritive value, selection and preparation for cooking, methods and principles involved in cooking. Fruits - Composition, nutritive value, changes during ripening, methods and effects of cooking, enzymatic browning.	2
3	Milk, meat and fish: Composition, nutritive value, kinds of milk, pasteurization and homogenization of milk, changes in milk during heat processing, preparation of cheese and milk powder. Meat- structure, composition, nutritive value, selection of meat, post mortem changes in meat, aging, tenderness, methods of cooking meat and their effects. Fish - Structure, composition, nutritive value, selection of fish, methods of cooking and effects.	3
4	Eggs and poultry: Structure, composition, classification, nutritive value, uses of egg in cookery, methods of cooking, foam formation and factors affecting foam formation. Poultry – types, composition, nutritive value, selection, methods of cooking.	4
	Section B	CLOs
5	Basic principles of meal planning: Basic principles and factors to be consider while planning menu for different age groups, My Plate. Recommended dietary allowances-RDA for Bangladeshi, basis for requirement of energy allowance for different growth pattern of children, energy allowance for various activities.	5
6	Nutritional needs during pregnancy and lactation: Nutrition during pregnancy-Stages of pregnancy normal growth and weight change, complications, nutritional requirements and meal planning. Nutrition during lactation - physiology of lactation, hormonal control, nutritional components of colostrum and mature milk. Nutritional requirements of lactating women. Meal planning.	6
7	Nutrition during Infancy: Growth and development, factors influencing growth, difference between breast feeding and bottle feeding, factors to be considered in bottle feeding, different types of milk formulae available commercially. Weaning foods – preparation of weaning foods, commercially and by other organizations. Uses of growth chart to monitor growth and development. Nutritional requirements of infants up to one year. Problems of feeding in normal and premature infants.	6
8	Therapeutic diets for the disorders: a. Under weight - definition, etiology, treatment b. Obesity - definition, etiology, treatment. c. Diseases of the gastro intestinal tract- ulcer, constipation and diarrhea. d. Diabetes mellitus – types, causes, symptoms, bio-chemical changes, dietary guidelines for management.	7

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Classify foods, understand functions and properties of foods.	1
	CLO2	Compare different food items from plant sources, understand their nutritional value and cooking methods to maintain minimal nutrient loss.	1, 2
	CLO3	Evaluate different food items from animal sources, understand their nutritional value and cooking methods to maintain minimal nutrient loss.	5
	CLO4	Compare the composition and nutritional values of eggs and poultry meats.	3, 10
	CLO5	Plan meals for different age categories of Bangladeshi people.	9, 10
	CLO6	Calculate the nutrients requirements for pregnant & lactating mothers and infants.	3, 9, 10
	CLO7	Suggests therapeutic diets for different nutritional disorders.	9, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Quiz and class test
CLO5	Lecturing, discussion	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecture and team teaching	Quiz and class test

Learning Materials

Recommended Readings	Shubhangini, A. J. 2015. Nutrition and Dietetics, 4th ed., TATA McGraw-Hill, New Delhi, India. Swaminathan, M. 1985. Essentials of food and Nutrition, 2nd ed., TATA McGraw-Hill, New Delhi, India. WHO. 1985. Energy and Protein Requirement, WHO publication, Geneva, Switzerland. Tull, A. 1997. Food and Nutrition, 3rd ed., Oxford University Press, New York. 288 P.
Supplementary Readings	Rosalind, S. G. 2005. Principles of Nutritional Assessment, Oxford University Press, New York, USA. Jelliffe, D. B. and Jelliffe, E. F. P. 1990. Community Nutrition Assessment. Oxford University Press, Oxford, New York. Bhuyan, A.H. and Nahar, N. 1990. Community Nutrition. Anisul, A. M. M. 2004. Nutrition. The Foundation of Health and Development. Srilakshmi, B. 2003, Food Science, 3rd ed., New Age Publishers, India.

Course Code: 0721 08 FT 2158		Year: Second	Term: First
Course Title	Food Technology Sessional and Fieldwork		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is designed to guide students in cooking and preparing various food items from both plant and animal ingredients.		
Course Objectives	To impart practical knowledge on manufacturing quality food products. Involve students in food preparation to minimize loss of nutritional quality.		

	Course Contents/Tasks	CLOs
1	Food grouping.	1
2	Cooking methods: Moist heat methods – (i) boiling, simmering, steaming, and pressure cooking, (ii) Dry heat methods – baking.	2
3	Methods of cooking fine and coarse cereals. Preparation of soups and salads.	2
4	Prevention of darkening in fruits and vegetables.	5
5	Milk & milk products: Common preparation with milk, cheese, curd and puddings.	3
6	Flesh foods: Fish, meat & poultry- preparations.	4
7	Egg experimental cookery: Boiled egg, poached egg.	4
8	Sensory evaluation and preparation of score card.	6
9	Visit to food industries.	6

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Group different food ingredients.	1
	CLO2	Cook and prepare food items from plant origin.	9, 10
	CLO3	Manufacture different dairy products.	9, 10
	CLO4	Cook and prepare food items from animal and fish origins.	9, 10
	CLO5	Increase the shelf-life of fruits and vegetables.	6,10
	CLO6	Analyze the operations of various food industries of both public and private ownership.	10, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation
CLO5	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation
CLO6	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation

Learning Materials

Recommended Readings	Rajalakslmi, R. 1914. Applied Nutrition. Oxford and IBH publication Co., Mumbai, India. Stanfield, S.P. and Hui Y. H. 2003. Nutrition and Diet Therapy (Self- Instructional Modules). 4th ed., Jones and Bartlett Publishers. Inc, USA. Joshi A. S. 2002. Nutrition and Dietetics. 2nd ed., Tata McGraw- Hill Publishing Company Limited, New Delhi. Srilakshmi, B. 2002. Dietetics. 5th ed., New Age Int. (P) Ltd., New Delhi.
Supplementary Readings	Anita F.P. and Abraham, P. 1966. Clinical dietetics & Nutrition. 4th ed., Oxford University Press, New Delhi. Stanley, D. 1986. Human Nutrition and Dietetics. 8th ed., Churchill Livingstone, London. Bogert, L.J., Briggs, G.M. and Calloway, D.H. 1979. Nutrition and Physical Fitness. 10th ed., W. B. Saunders co.

Second Year Second Term			
Course Code: 081108 AT 2201		Year: Second	Term: Second
Course Title	Seed Technology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	Seed is one of the major inputs of agriculture. This course covers various aspects of seed and seed quality, production and quality control of seed.		

Course Contents		CLOs
Section A		
1	Introduction: Definition of seed and seed technology; scope of seed technology; classification and importance of seed; internal and external structures of seed.	1
2	Chemistry of seed: Chemical composition of seed and its impact on seed quality.	2
3	Germination of seed: Factors, mechanism and types of seed germination; normal and abnormal seedling; physiology of seed germination.	2
4	Dormancy of seed: Importance, causes and types; breaking of seed dormancy.	2
5	Seed longevity and deterioration: Concept; causes and symptoms of seed deterioration; life span of seed.	2
Section B		CLOs
6	Seed quality: Seed quality and quality seed; factors affecting quality of seed during production, processing and storage; quality control of seed.	3
7	Processing and storage of seed: Drying, cleaning and grading of seeds; principles and techniques of seed storage.	3
8	Seed testing: Objectives of seed testing; seed sampling; seed testing for purity, germination, viability and vigor.	4
9	Seed treatment: Objectives and methods of seed treatment.	4
10	Seed production and supply: Production technology of quality seeds; role of national seed board, seed certification agency and other organizations in production and supply of quality seed in Bangladesh.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe importance of seed and seed technology.	1
	CLO2	Discuss various aspects of seed germination, seed dormancy, seed longevity and deterioration.	1
	CLO3	Explain principles and techniques of seed production, processing and storage.	1, 2
	CLO4	Compare different methods of seed treatment and seed testing.	1, 2, 5
	CLO5	Evaluate seed production and distribution in Bangladesh emphasizing the role of different GOs and NGOs.	1, 2, 3, 5, 7, 9, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, video show	Continuous assessment (Formative: Quiz, assignment, objective, active class participation) and summative (Term final)
CLO2	Lecturing, demonstration, group discussion	Continuous assessment (Formative: Objective, assignment, question-answering, presentation) and summative (Term final)
CLO3	Lecturing, demonstration, group discussion	Continuous assessment (Formative: Assignment, MCQ, presentation) and summative (Term final)
CLO4	Group discussion, demonstration, presentation, debate	Continuous assessment (Formative: Objectives, assignment, question-answering, presentation) and summative (Term final)
CLO5	Lecturing, field visit, presentation	Continuous assessment (Formative: Objectives, assignment, assigned task, report) and summative (Term final)

Learning Materials

Recommended Readings	Agrawal, R.L. 1986. Seed Technology. Oxford and IBH Publishing Co. New Delhi. Bala, B.K. 1997. Drying and Storage of Cereal Grains. Science Publishers, Inc. USA. Bewley, J.D. and Black, M., 1984. Physiology and Biochemistry of seed in relation to germination (Vol. I & II), Springer-Verlag, Berlin. Copeland, L.O. 1976. Principles of Seed Science and Technology. Bargress Publishing Co. Minnesota, USA. International Seed Testing Association (ISTA). 1976. International Rules for Seed Testing. Seed Science and Technology. Vol 4. P. 3-49.
Supplementary Readings	Justice, O.L. and Bass, L.N. 1978. Principles and Practices of Seed Storage. Agricultural Hand Book No. 506. Mayer, M. and Poliankaff-Mayber. 1989. The Germination of seeds, 4th ed., Pergamon Press plc, Headington Hill Hall, Oxford OX3 OBW, England. Nema, N.P. 1985. Principles of Seed Certification and Testing. Selied Publishers Limited, New Delhi. Seed Certification Agency. 1976. Seed Certification Manual. Ministry of Agriculture, Govt. of the People's Republic of Bangladesh. Seed Certification Agency. 1992. Proceedings of National seed Technology Seminar. MOA. Govt. of the Peoples Republic of Bangladesh. USDA. 1961. Seeds. The Yearbook of Agriculture 1961. The United States Department of Agriculture, Washington, D.C.

Course Code: 0811 08 AT 2202		Year: Second	Term: Second
Course Title	Seed Technology Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is included to deliver practical knowledge on seed, seed testing, seed production, processing and storage.		

	Course Contents/Tasks	CLOs
1	Study of structures of seed.	1, 2
2	Seed sampling.	3
3	Purity, germination, viability and vigour tests of seed.	3
4	Seed grading.	3
5	Seed moisture determination.	3
6	Growing of a seed crop with special reference to rouging and grading.	4
7	Visit to different public and private sector seed farms.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify crops seed and prepare seed album.	1, 2, 9
	CLO2	Explain external and internal parts of seeds.	1, 2, 9
	CLO3	Evaluate purity, germination, viability, vigor and moisture content of seed.	1, 2, 5, 8, 9
	CLO4	Grow seed crops for producing quality seed.	1, 2, 5, 9
	CLO5	Analyze the activities of GOs and NGOs relating certified seed production and distribution in Bangladesh.	1, 2, 7, 9, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, demonstration	Sessional assessment (Formative: Quiz, lab. work, active class participation and viva)
CLO2	Lecturing, discussion, demonstration	Sessional assessment (Formative: Quiz, lab. work, active class participation and viva)
CLO3	Lecturing, video, demonstration, field visit, group discussion, report writing	Sessional assessment (Formative: Lab. work, active class participation, question-answering, presentation and viva)
CLO4	Group discussion, demonstration, presentation, debate, assignment, case study	Sessional assessment (Formative: Quiz, lab. work, active class participation and viva)
CLO5	Seed farm visit	Sessional assessment (Formative: Report, presentation and viva)

Learning Materials

Recommended Readings	Agrawal, R.L. 1986. Seed Technology. Oxford and IBH Publishing Co. New Delhi. Bala, B.K. 1997. Drying and Storage of Cereal Grains. Science Publishers, Inc. USA. Bewley, J.D. and Black, M., 1984. Physiology and Biochemistry of seed in relation to germination (Vol. I & II), Springer-Verlag, Berlin. Copeland, L.O. 1976. Principles of Seed Science and Technology. Bargress Publishing Co. Minnesota, USA. International Seed Testing Association (ISTA). 1976. International Rules for Seed Testing. Seed Science and Technology. Vol 4. P. 3-49.
Supplementary Readings	Justice, O.L. and Bass, L.N. 1978. Principles and Practices of Seed Storage. Agricultural Hand Book No. 506. Mayer, M. and Poliankaff-Mayber. 1989. The Germination of seeds, 4th ed., Pergamon Press plc, Headington Hill Hall, Oxford OX3 OBW, England. Nema, N.P. 1985. Principles of Seed Certification and Testing. Selied Publishers Limited, New Delhi. Seed Certification Agency. 1976. Seed Certification Manual. Ministry of Agriculture, Govt. of the People's Republic of Bangladesh. Seed Certification Agency. 1992. Proceedings of National seed Technology Seminar. MOA. Govt. of the Peoples Republic of Bangladesh. USDA. 1961. Seeds. The Yearbook of Agriculture 1961. The United States Department of Agriculture, Washington, D.C.

Course Code: 0811 08 AT 2203		Year: Second	Term: Second
Course Title	Soil Survey and Soil Physics		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The graduates are intended to provide knowledge of soil physical properties, soil classification and issue of problem soil		

	Course Contents	CLOs
	Section A	
1	Soil survey: Introduction, objectives, kinds and methods of soil survey; field study, mapping and report preparation.	1
2	Soil classification: Principles of soil classification; study of soil taxonomy-properties of diagnostic horizons and soil categories	1, 2
3	Land classification: Criteria and methods of land evaluation; land capability classification of Bangladesh.	1
4	Soils of Bangladesh: Physiographic units, physiography and soil types; crop productivity constraints and ecological hazards.	1
5	Soil erosion: Types, factors affecting soil erosion; soil erosion in Bangladesh; impact and control of soil erosion; universal soil loss equation.	2
	Section B	CLOs
6	Physical properties of soil: Concept, soil density, porosity, texture, structure; shrinkage and swelling; soil air and soil temperature.	3
7	Soil water: Sources, importance and classification of soil water, soil water constants; infiltration-definition, factors affecting infiltration; soil water potential-definition and components; factors affecting irrigation and drainage.	3
8	Soil salinity: Origin and characteristics of saline and alkali soils; saline soils of Bangladesh-causes, extent, location and management.	4
9	Evapotranspiration (ET): Definition, factors affecting ET; methods of measuring ET; application of ET values for irrigation scheduling.	4
10	Soil consistency: Definition and forms; Atterberg's limits; plough pan formation and its effect on soil properties and crop production.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe different soil and land classification.	1, 2, 7
	CLO2	Enumerate physical, chemical and biological properties of soil.	1
	CLO3	Explain different issues regarding problem soils with their management practices.	1, 3, 11
	CLO4	Annotate plant- soil water relationship for crop production.	1

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Quiz, objectives, active class participation, assignment) and summative (Term final)
CLO2	Lecture, video	Continuous (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO3	Lecture, group discussion, video	Continuous (Formative: Viva, presentation, active class participation) and summative (Term final)
CLO4	Lecture and field visit	Continuous (Formative: Active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Baver, L.D. 1985. Soil Physics. John Wiley and Sons. New York.
Supplementary Readings	Brady, N.C. 1990. The Nature and Properties of Soils. Macmillan Pub. Comp. New York. Ghildyal, B.P. and Tripathi, P.R. 1987. Soil Physics. Wiley Eastern Ltd. New Delhi.

Course Code: 0811 08 AT 2204	Year: Second	Term: Second
Course Title	Soil Survey and Soil Physics Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	Basic Soil Science	
Rationale	The graduates are intended to provide practical and applied knowledge on measuring soil survey and soil physical properties	

	Course Contents/Tasks	CLOs
1	Determination of soil moisture, particle density, bulk density, porosity, colour, field capacity and pore size distribution of soil.	1, 2
2	Estimation of soil water tension and infiltration.	2
3	Measurement of Atterberg limits- liquid limit, plastic limit and plasticity index.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Determine soil moisture, particle density, bulk density, porosity, color, field capacity.	1, 2, 7
	CLO2	Estimate soil water tension and infiltration.	1
	CLO3	Assess Atterberg limits- liquid limit, plastic limit.	1, 6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Active class participation, assignment) and summative (Term final)
CLO2	Lecture, video	Continuous (Formative: Objectives, active class participation) and summative (Term final)
CLO3	Lecture, group discussion	Continuous (Formative: Viva, active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Baver, L. D. 1985. Soil Physics. John Wiley and Sons. New York.
Supplementary Readings	Brady, N. C. 1990. The Nature and Properties of Soils. Macmillan Pub. Comp. New York. Ghildyal, B.P. and Tripathi, P.R. 1987. Soil Physics. Wiley Eastern Ltd. New Delhi.

Course Code: 0811 08 AT 2205		Year: Second	Term: Second
Course Title	Cytology, Genetics, and Cytogenetics		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course intends to provide fundamental knowledge on chromosomes, inheritance, and basic principles of genetics with a particular preference to plants.		

Course Contents		CLOs
	Section A	
1	Introduction: Importance, branches, and historical development of genetics.	1
2	Cytology: Plant cell constituents of genetic importance, morphological structure of eukaryotic chromosomes and their nomenclature, prokaryotic chromosomes and their characteristics; chemical organization of chromosomes; special types of chromosomes, karyotype characteristics; cell division in a diploid organism.	1, 2
3	Heredity and variation: Definition of heredity, the physical basis of the heredity-chromosome theory of heredity, experimental evidence to prove that genes are situated on chromosomes; variation- definition, types and significance, variation and its role on speciation, causes of genetic variation in sexually and asexually reproducing organisms.	3
4	Mendel's law of inheritance and their modifications: Laws of segregation and independent assortment, exceptions to the laws, types of gene action, intra and inter-allelic interaction of genes, multiple alleles-test of allelism, examples of multiple alleles, quantitative traits- multiple factor hypotheses, difference between qualitative and quantitative traits, comparison of Mendelian inheritance with polygenic inheritance, pleiotropism, penetrance and expressivity.	3
5	Extra-nuclear inheritance and maternal effect: Cytoplasmic inheritance- definition, characteristic features of cytoplasmic inheritance, chloroplast inheritance, differences between chromosomal and extra chromosomal inheritance.	3
	Section B	CLOs
6	Gene: Classical and modern concept, evidence of DNA as genetic material, classification of genes; DNA and its structure, function, types, modes of replication and repair; RNA and its structure, function and types; transcription, translation, genetic code and outline of protein synthesis.	4
7	Cytogenetics: Structural and numerical changes of chromosomes, their meiotic behavior and cytogenetic consequence; cytogenetics of rice and wheat in relation to (i) origin and distribution of the cultigen and related species (ii) genomic constitution of the phylogenetically related species.	4
8	Crossing over (CO) and linkage: CO-definition, types, mechanism, factors affecting CO, cytological proof and genetic consequences of CO; significance of CO in plant breeding; linkage- definition, types, linkage groups, detection and estimation of linkage, importance of test cross in linkage study, significance of linkage in plant breeding, genetic map using two and three-point test cross, coincidence, interference,	4
9	Sex-determination and sex-linked inheritance: Sex chromosome, characteristics of sex chromosomes, mechanism of sex determination, sex-linked genes in plants and animals, sex-limited and sex influenced characters	5
10	Mutation: Definition, characteristics, classification and causes of mutation; mutagen and their effects, methods of detection (autosomal and sex-linked), mechanisms of mutation, significance of mutation in plant breeding.	5

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Describe the sequential development of genetics and depict different cellular parts of genetic importance.	2
	CLO2	Explain the mechanism of heredity, cytogenetics and causes of variation, and its role in speciation.	2
	CLO3	Analyze the Mendelian and non-Mendelian patterns of inheritance and extra-nuclear inheritance.	2, 3, 8
	CLO4	Construct a genetic map following linkage and crossing over.	3, 4, 8
	CLO5	Assess the mode of action of mutagens.	2

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Active participation, quiz
CLO2	Lecture, group discussion	Active participation, written examination, quiz
CLO3	Lecture, assignment, group discussion, tutorial	Active participation, written examination, quiz, assignment
CLO4	Lecture, assignment, group discussion, tutorial	Active participation, written examination, quiz, assignment, presentation
CLO5	Lecture, assignment, group discussion, tutorial	Active participation, written examination, quiz, assignment, presentation

Learning Materials

Recommended Readings	Asche, J. 2013. Recent Advances in Cloning, Genetics and Stem Cell Technology. Random Pub. India. Singh, B. D. 2004. Genetics. Kalyani Publishers, New Delhi.
Supplementary Readings	Ringo, J. 2012. Fundamental Genetics. CUP, India. Tamarin, R.H. 1996: Principles of Genetics. Fifth edition. McGraw-Hill Companies, Inc. United States of America. Sambamurty, A.V.S.S. 2007: Molecular Genetics. Narosa Publishing House. New Delhi. Sing, P. 2004: Genetics. Kalyani Publishers, New Delhi. Singh, R.K. and Singh, P.K. 1994: A Manual of Genetics and Plant Breeding Experimental Techniques. Kalyanipublishers, New Delhi. Snustad, D.P., Simmons M.J. and Jenkins J.B. 1997. Principles of Genetics. John Wiley & Sons, Inc. New York. Stent, G.S. and Calendar, R. 2004. Molecular Genetics: An Introductory Narrative. CBS Publishers & Distributors, New Delhi. Tamarin. 2012. Principles of Genetics. TMH, India. Verma, P.S. and Agarwall, V.K. 2005. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd. New Delhi. Vijendra D.L.D. 1998. Plant Breeding. New Age International (P) Limited, Publishers, New Delhi. Singh, B. 2006. Molecular Bioology and Biotechnology. Aavishkar Publishers, Distributors, Jaipur, India. De Robertis, E.D.P. and De Robertis Jr. 1999. Cell and Molecular Biology. B.I. Publications Private Ltd. Falconer, D.S. 1981. Introduction to Quantitative Genetics. Longman Inc., New York. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B. and Doebley, J. 2008. Introduction to Genetic analysis. Cambridge Univ. Press, USA. Gupta, P.K. 1997. Genetics. Rastogi Publications. New Delhi. Jain, H.K. 2004. Genetics Principles, Concepts and Implications. Oxford and IBH publishing Co. New Delhi. Lewin, B. 2004. Gene VIII. Oxford University Press. New York, USA. Monroe W.S. 2002. Genetics. Prentice- Hall of India Private Limited, New Delhi. Osborn, M. 2013. Recent Advances in Cytology and Genetics. Random Pub. India. Peter, K.V. 1998. Genetics and Breeding of Vegetables. Published by Directorate of Information and Publications of Agriculture. New Delhi.

Course Code: : 0811 08 AT 2206	Year: Second	Term: Second
Course Title	Cytology, Genetics, and Cytogenetics Sessional	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	The course is designed to make the students understand different aspects of cell division and solve problems related to mendelian and non-mendelian genetics.	

	Course Contents/Tasks	CLOs
1	Microscopic study of different stages of mitosis and meiosis.	1, 2
2	Problems with Mendelian inheritance pattern.	3
3	Problems with modified mendelian ratios.	3
4	Problems with linkage.	3
5	Problems with two and three-point test cross of crossing over.	3, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Handle the microscope properly and safely.	2, 11, 12
	CLO2	Prepare temporary slides.	2, 11, 12
	CLO3	Solve problems related to qualitative and quantitative inheritance.	2, 3, 4
	CLO4	Analyze and interpret the results of their investigations.	2, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lectures, slide preparation, group discussion	Quiz, written examination, viva voce
CLO2	Lectures, slide preparation, demonstration of different stages of cell division, group discussion	Temporary slide preparation, identifying dividing cells, assignment, viva voce
CLO3	Lectures, slide preparation, field visit, group discussion	Quiz, written examination, identifying dividing cells, problem solving, assignment, viva voce
CLO4	Lectures, field visit, group discussion	Quiz, written examination, problem solving, data analysis and interpretation, assignment, viva voce

Learning Materials

Recommended Readings	Falconer, D.S. 1981: Introduction to Quantitative Genetics. Longman Inc., New York. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B. and Doebley, J. 2008. Introduction to Genetic analysis. Cambridge Univ. Press, USA. Gupta, P.K. 1997: Genetics. Rastogi Publications. New Delhi. Osborn, M. 2013: Recent Advances in Cytology and Genetics. Random Pub. India.
Supplementary Readings	Singh, R.K. and Singh, P.K. 1994. A Manual of Genetics and Plant Breeding Experimental Techniques. Kalyani publishers, New Delhi. Snustad D.P. and Simmons M.J. 2015. Principles of Genetics. John Wiley & Sons, Inc. New York. Michael, P.W., Stacey B.G. and Claiborne, S. (eds.), 2007. Genetic Variation: A Laboratory Manual, Cold Spring Harbor Laboratory Press, New York.

Course Code: 0715 08 AT 2207		Year: Second	Term: Second
Course Title	Agrimachinery and Farm Mechanization		
Course Status	Optional		
Credit	2.0		
Prerequisite(s)	None		
Rationale	The course is to provide students with current understanding of heavy-duty agricultural implements and farm mechanization along with construction materials.		

	Course Contents	CLOs
	Section A	
1	Introduction: Farm mechanization and its scope and importance in Bangladesh; source of agricultural power and its application.	1
2	Engine: Operating principle of IC engine; difference between 4-stroke and 2-stroke engines; petrol and diesel engines; fuel and ignition systems; cooling and lubrication systems; power transmission system; estimation of power; energy and efficiency of engine.	2, 3
3	Repairing and maintenance: Trouble in engine systems; repair and maintenance.	2, 3
	Section B	CLOs
4	Farm machinery: Tillage, crop planting, plant protection, irrigation, harvesting, threshing and drying machines.	1, 2
5	Economic performance of farm machines: Economic performance of machines and equipment; selection of machines.	2
6	Common engineering and building materials: Brick, sand, cement and timber; their constituents and uses; estimation of common building structures.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain basic principles of farm mechanization and its application.	1, 2, 7
	CLO2	Estimate performance potential of agricultural heavy-duty engines and analyze its cost benefit ratio.	1, 2, 6
	CLO3	Operate IC engines with precautions and maintenance.	1, 6, 9
	CLO4	Verify the common engineering and building materials.	1, 2, 6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, brain storming and problem solving	Quiz, class test, assignment and final exam
CLO2	Lecture, group discussion, brain storming and problem solving	Presentation, class test, quiz, assignment and final exam
CLO3	Lecture, group discussion, brain storming and problem solving	Class test, viva voce, report wring and final exam
CLO4	Lecture, group discussion, brain storming and problem solving	Quiz, assignment, class test and final exam

Learning Materials

Recommended Readings	Claude, C. 1992. Farm Machinary. 12th ed., Blackwell Scientific Publications, London. Hafiz, M. A. 1990. A Text Book of Engineering Materials. Book Centre, Dhaka.
Supplementary Readings	Hansen, V. E., Israelson, O.W. and Stringham, G.E. 1993. Irrigation Principles and Practices, John Wiley & Sons, New York. Hopper, H. J. 1981. Farm Impliments for Arid and Tropical Region. Oxford and IBH Publishing Company. Hunt, D. 1983. Farm Power and Machinery Management. Iowa State Univ. Press, Ames. Kepner, R.A. Bainer, R. and Barger, E.L. 1983. Principle of Farm Machinery. AVI. Pub., New York.

Course Code: 0715 08 AT 2208	Year: Second	Term: Second
Course Title	Agrimachinery and Farm Mechanization Sessional and Fieldwork	
Course Status	Optional	
Credit	1.0	
Prerequisite(s)	None	
Rationale	The course is to provide students with practical learning on heavy-duty agricultural implements and farm mechanization along with construction materials.	

	Course Contents/Tasks	CLOs
1	Study of common hand tools, identification and use of major parts of engine.	1
2	Study of fuel system, ignition system, cooling and lubrication system.	1, 2
3	Power transmission system of C.I. and S.I. engines.	2
4	Operation of farm machineries.	2
5	Practical problems on construction materials and estimation.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify and use major parts of engine.	1, 4, 9
	CLO2	Operate and maintain farm engines.	2, 7, 9
	CLO3	Evaluate the construction materials.	1, 4, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Demonstration, group discussion, case study and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO2	Lecture, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO3	Lecture, group discussion, demonstration, and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final

Learning Materials

Recommended Readings	Claude, C. 1992. Farm Machinary. 12th ed., Blackwell Scientific Publications, London. Hafiz, M. A. 1990. A Text Book of Engineering Materials. Book Centre, Dhaka.
Supplementary Readings	Hansen, V.E., Israelson, O.W. and Stringham, G.E. 1993. Irrigation Principles and Practices, John Wiley & Sons, New York. Hopper, H. J. 1981. Farm Impliments for Arid and Tropical Region. Oxford and IBH Publishing Company. Hunt, D. 1983. Farm Power and Machinery Management. Iowa State Univ. Press, Ames.

Course Code: 0811 08 AT 2209		Year: Second	Term: Second
Course Title	Methods in Plant Pathology		
Course Status	Optional		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course is oriented to provide practical knowledge regarding laboratory procedures of plant pathology		

	Course Contents/Tasks	CLOs
1	Spore counting, centrifugation, chromatography, spectrophotometry and pH adjustment.	1
2	Methods of isolation of plant pathogenic fungi, bacteria, virus and nematode.	1
3	Techniques of isolation purification, multiplication and preservation of plant pathogens.	1
4	Detection techniques of plant pathogenic fungi, bacteria, virus and nematode.	1
5	Techniques of inoculation of plant pathogenic fungi, bacteria, virus and nematode.	2
6	Evaluation of anti-pathogenic chemicals.	3
7	Screening germplasms for disease resistance.	4
8	Demonstration of pathogenicity.	1
9	Plotting disease progress curve of epidemic and sporadic disease.	5
10	Estimation of yield loss due to infectious disease.	4
11	Photography.	5
12	Technical report writing and editing.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Apply Koch's postulates by usingfungi, bacteria, nematodes & viruses.	1, 5, 9, 10
	CLO2	Use, handle and care of laboratory equipment's, glass wares and consumables.	1, 9
	CLO3	Evaluate of anti-pathogenic chemicals.	1, 5
	CLO4	Screen germplasms and estimate of yield loss.	1, 5, 9
	CLO5	Analyze case study and write reports.	1, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Demonstration, identification, isolation of plant pathogens, multiplication and preservation of plant pathogens, pathogenicity test of different plant pathogens, group discussion, case study	Quiz, assignment, active class participation, sudden lab test and viva voce and final exam
CLO2	Demonstration of inoculation method of plant pathogens, group discussion on disease symptoms study, individual case study	Quiz, short questions, MCQ, presentation, assignment, active class participation, sudden test, question-answering, viva voce and final exam
CLO3	Demonstration, group discussion, review research study	Quiz, short questions, MCQ, presentation, viva voce and final exam
CLO4	Demonstration, screening of germplasm against plant pathogens, group discussion, field visit	Quiz, assignment, active class participation, sudden lab test and viva voce and final exam
CLO5	Epidemiological study of plant pathogens, group discussion, demonstration of yield loss, case study, assignment, group discussion for report writing technique	Quiz, assignment, active class participation, sudden lab test and viva voce and final exam

Learning Materials

Recommended Readings	Agricultural Research Council (ARC). 1990. The Nutrient Requirements of Ruminant Livestock. Commonwealth Agricultural Bureaux, Slough, England. Atherton, H.V. and Newlander, J.A. 2004. Chemistry and Testing of Dairy Products. 4th ed., CBS Publishers and Distributors, New Delhi. Chauhan, H.V.S. and Roy, S. 2010. Poultry Diseases Diagnosis and Treatment. 3rd ed., New Age International Publishers, New Delhi. Davis, R.F. 1965. Modern Dairy Cattle Management. Prentic Hall Inc. EngleweedChiffs, N.J., USA. Engineering India Research Institute (EIRI). 2012. Hand Book of Dairy farming to Produce Milk with Packaging.
Supplementary Readings	Vashista, B.R. 2010. Botany for Degree Students' Fungi. S. Chand and company, New Delhi. Verma, H.K. 2012. A text book of Fungi. Random Publications. New Delhi Neshiem, M. C., Austic, R. E. and Card, L. E. 1979. Poultry Production. 12th ed., Lea and Febiger, Philadelphia, USA. Neeraj, J. P. 2010. Principles and Practices of Dairy Farm Management. 6th ed., Kalyani Publishers, New Delhi. Sethumadhavan, T.P. 2004. Sustainable Dairy Farming: An Overview. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. Sharma, H., H. Pandey, and C. Singh. 2009. Objective Questions in Dairy Science and Technology and Food and Dairy Engineering. CBS Publishers and Distributors Pvt. Ltd. New Delhi. Srivastava, S.M. 1998. Milk and Its Properties. Kalyani Publishers, New Delhi. Garnsworthy, P.C. 1988. Nutrition and Lactation in the Dairy cow. Butterworths, Kent, England. Mahindru, S.N. 2009. Milk and Milk Products. A P H Publishing Corporation, New Delhi. Mountney, G.J. and Parkhurst, C.R. 2001. Poultry Products Technology. 3rd ed., Food Products Press.

Course Code: 0811 08 AT 2211		Year: Second	Term: Second
Course Title	Feeds, Fodder and Animal Nutrition		
Course Status	Optional		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course is oriented to provide students the information of feeds and fodders, their digestions and utilization in ruminants and non-ruminants.		
Course Objectives	To teach the learners about feeds and fodders, their digestions and utilization in ruminants and non-ruminants. To acquaint knowledge on feed evaluation and digestive physiology.		

Course Contents		CLOs
	Section A	
1	Introduction: Definition of nutrition and nutrients, composition of plant and animal body and interrelationships between them.	1
2	Nutrients: Definition, classification and general functions; functions, deficiency symptoms and feed sources of each nutrient in ruminants and poultry.	1
3	Digestive physiology of ruminants: Definition of digestion, digestive system of ruminants and comparison with that of non-ruminants; digestive juices, their sources and functions; functions of rumen microorganisms.	2
4	Feed evaluation: Objectives and methods of feed evaluation, digestibility of feeds, factors affecting digestibility, biological partitioning of energy.	3
5	Digestion and metabolism of nutrients: Digestion and metabolism of carbohydrates and protein in ruminants.	3
	Section B	CLOs
6	Feeds and fodders: Classification; nutritional characteristics of feeds, fodders and supplements.	4
7	Fodder production: Types of fodders, methods of production of leguminous and non-leguminous fodders; factors affecting nutritive value of fodders.	4
8	Conservation of feeds and fodders: Importance of conservation, methods of conservation-hay making, silage making; chemical changes and losses of nutrients during conservation of fodders.	4
9	Un-conventional feed utilization: Utilization of agro-industrial by-products-fibrous crop residues, their chemical nature, methods of improvement of nutritive value through various treatments.	5
10	Feeding livestock: Feeding standards for farm animals- feeding of dairy and beef cattle; computation of balance rations for dairy and beef cattle.	6

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Describe functions, deficiency symptoms and sources of nutrients.	1, 2
	CLO2	Digestive physiology, digestion and metabolism process in ruminants and non-ruminants.	2
	CLO3	Illustrate different methods of feed evaluation.	10
	CLO4	Optimize fodder production technique and conservation methods of animal feed.	5
	CLO5	Illustrate feeding standards and formulation of balanced ration for farm animals.	9, 10
	CLO6	Illustrate agro-industrial by-products and unconventional feed stuffs.	1, 4

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion, report writing	Assignment, viva voce and final exam
CLO4	Lecture and group discussion, report writing	Assignment, viva voce and final exam
CLO5	Problem-based learning and presentation	Assignment and final exam
CLO6	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, viva voce and final exam

Learning Materials

Recommended Readings	Banerjee, G.C. 1988. Feeds and Principles of Animal Nutrition. Oxford and IBH Pub. Co. Pvt. Ltd. Mc. Donald, P., Edwards, R.A., Greenhalgh, J.F.D. and Morgan, C.A. 2008. Animal Nutrition. 4th ed., Dorling Kindersley (India) Pvt. Ltd. Licensees by Pearson Education India. Pathak, N. 1997. Textbook of Feed Processing Technology. Vikas Publishing House Pvt. Ltd. Pond, W.G., Church, D.C., Pond, K.P. and Schokecht, P.A. 2006. Basic Animal Nutrition and Feeding. 5th ed., Wiley, India.
Supplementary Readings	Reddy, V.R. and Bhosale, D.T. 2001. Handbook of Poultry Nutrition. American Soybean Association, New Delhi, India. Singh, K.S. 1997. Animal Nutrition. Kalyani Publishers, New Delhi. Verma, D.N. 1995. A Text Book of Animal Nutrition. Kalyani Publishers, New Delhi. Wong, N.P., Jenness, R., Keeney, M. and Marth, E.H. 1998. Fundamentals of Dairy Chemistry, 3rd ed., CBS Publishers and Distributors, New Delhi. Prasad, J. 2012. Principles and Practices of Animal Nutrition. 3rd ed., Kalyani Publishers, New Delhi. Ranjhan, S.K. 1993. Animal Nutrition and Feeding Practices. 4th ed. Vikash Pub. House. Pvt. Ltd. Reddy, D.V. 2008. Applied Nutrition: Livestock, Poultry, Human, Pet, Rabbit and Laboratory Animal Nutrition. Oxford and IBH Publishing Co., New Delhi.

Course Code: 0811 08 AT 2212		Year: Second	Term: Second
Course Title	Feeds, Fodder and Animal Nutrition Sessional and Fieldwork		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is oriented to provide students applied knowledge on animal nutrition. Application of practical knowledge on feeds, fodder and animal nutrition.		
Course Objectives	To acquaint the learners practically about different aspects of feeds, fodder and animal nutrition. To evaluate chemical composition and nutritive value of feeds and fodders.		

	Course Contents/Tasks	CLOs
1	Principles and procedures of proximate analysis-dry matter, crude protein, crude fibre, ash and ether extract.	1
2	Identification of livestock feeds and fodders.	2
3	Demonstration on the production of fodders.	3
4	Field trips.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	estimate different components of feed and fodders through proximate analysis.	10
	CLO2	identify livestock feeds and fodders.	9
	CLO3	demonstrate fodder production.	9
	CLO4	acquire hands-on knowledge on feeds and fodder production.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Problem-based learning and presentation	Quiz and class test
CLO2	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam
CLO3	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Quiz and class test

Recommended Readings	Banerjee, G.C. 2011. A Text Book of Animal Husbandry. 8th ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. Dutt, C. 2006. Analytical Techniques in Poultry Nutrition. Kalyani Publishers, New Delhi. Mc. Donald, P., Edwards, R.A., Greenhalgh, J.F.D. and Morgan, C.A. 2008. Animal Nutrition. 4th ed., Dorling Kindersley (India) Pvt. Ltd. Licensees by Pearson Education India. Pathak, N. 1997. Textbook of Feed Processing Technology. Vikas Publishing House Pvt. Ltd. Ranjhan, S.K. 1993. Animal Nutrition in the Tropics. 3rd revised ed. Vikas Pub. House. Pvt. Ltd.
Supplementary Readings	Reddy, V.R. and D.T. Bhosale. 2001. Handbook of Poultry Nutrition. American Soybean Association, New Delhi, India. Sastry, N.S.R. and Thomas, C.K. 2005. Livestock Production Management. 4th ed., Kalyani Publishers, New Delhi. Singh, K.S. 1997. Animal Nutrition. Kalyani Publishers, New Delhi. Verma, D.N. 1995. A Text Book of Animal Nutrition. Kalyani Publishers, New Delhi. Reddy, D.V. 2008. Applied Nutrition: Livestock, Poultry, Human, Pet, Rabbit and Laboratory Animal Nutrition. Oxford and IBH Publishing Co., New Delhi.

Course Code: 0542 08 Stat 2253	Year: Second	Term: Second
Course Title	Statistics	
Course Status	Core	
Credit	2.0	
Prerequisite(s)	None	
Rationale	Students of Agrotechnology Discipline need detailed knowledge on statistics during professional life. This course intends to frame various ideas and concepts of statistics in reasonable ways.	

	Course Contents	CLOs
	Section A	
1	Introduction: Definition of statistics, its use and limitations, population sample, functions of statistics, collection of statistical data. formation of frequency distribution. diagrammatic and graphical presentation of statistical data.	1
2	Measures of central tendency: Characteristics of an ideal measures of central tendency. arithmetic mean, median, mode, geometric mean and harmonic mean. comparisons of these averages and the selection of appropriate average. properties of arithmetic mean. weighted arithmetic means.	2
3	Measures of dispersion: Definition. characteristics of a good measure of dispersion. range, quartile deviation, mean deviation and standard deviation. relative measures of dispersion – coefficient of variation. skewness, kurtosis and their measures.	2
4	Probability: Definition and concept of probability, addition, multiplication on probability. concept of probability distribution, binomial, poisson and normal distributions.	3
	Section B	CLOs
5	Correlation: Scatter diagram, correlation coefficient, rank correlation coefficient, application of correlation in agriculture, regression, linear regression and its applications in agriculture, interpretation of regression coefficients.	4
6	Tests of statistical hypothesis: Definition of hypothesis. type I and II errors, steps involved in testing of hypothesis, level of significance and degrees of freedom, critical region, large sample tests – Z transformation of the correlation coefficient, small sample tests.	5
7	Tests for equality of means and variances, t and F tests, paired t-Test. Tests of significance of correlation coefficient: Chi-Square Test, assumptions, limitations and applications, contingency table, analysis of variance.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Organize statistical data.	1, 2, 9, 10
	CLO2	Elucidate different measures of location and dispersion.	1, 9, 10
	CLO3	Apply probability theories in the field of agriculture.	1, 2, 3, 9, 10
	CLO4	Determine bivariate relationship.	1, 2, 3, 9, 10
	CLO5	Conduct various statistical tests.	1, 2, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion	Continuous assessment (Formative: Objectives, active class participation, assignment) and summative (Term final)
CLO2	Lecturing, demonstration, group discussion, report writing	Continuous assessment (Formative: Problems, active class participation) and summative (Term final)
CLO3	Lecturing, video, demonstration	Continuous assessment (Formative: Problems, active class participation) and summative (Term final)
CLO4	Group discussion, demonstration, presentation, exercise	Continuous assessment (Formative: Problems, active class participation) and summative (Term final)
CLO5	Group discussion, presentation, debate	Continuous assessment (Formative: Problems, active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Balakrishnan, N. 2002. Statistical Methods and Practice. Prentice Hall of India. Chakravorthi, S.R. and Giri, N. 2002. Basic Statistics. South Asian Publishers, New Delhi. Cochran, W.G. 1989. Sampling Techniques. Oxford and IBH Publishing Co. Croxton, F.E. and Cowden, D.J. 1966. Applied General Statistics. Prentice Hall of India Pvt. Ltd., New Delhi. Zar, J.H. 2005. Biostatistical Analysis. 4th ed., Pearson Education, India.
Supplementary Readings	Fisher. R.A. 1950. Statistical Methods for Research Workers. 11th ed., Oliver & Boyd, Edinburg. Fisher, R.A. and Yates, F. 1948. Statistical Tables for Biological, Agricultural and Medical Research. Oliver & Boyd, Edinburg. Gupta, S.C. and Kapoor, V.K. 1997. Fundamentals of Mathematical Statistics. Sultan Chand & Sons Publisher, New Delhi. Panse, V.G. and Sukhatme, P.V. 1967. Statistical Methods for Agricultural Workers. ICAR, New Delhi. Rangaswamy, R. 2002. A text book of Agricultural Statistics. John Wiley & Sons. Snedecor, G.W. and Cochran, W.G. 1992. Statistical Methods. Oxford and IBH Publishing Co.

Course Code: 0542 08 Stat 2254		Year: Second	Term: Second
Course Title	Statistics Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course describes the statistical procedures in agricultural research.		

	Course Contents/Tasks	CLOs
1	Formation of Frequency Distributions, Diagrammatic and Graphical presentations.	1
2	Computation of different measures of Central Tendency and Dispersion, Coefficient of Variation, Coefficient of Skewness and Kurtosis, Simple Correlation Coefficient.	2
3	Regression Coefficient, Rank Correlation Coefficient and Coefficient of Concordance. Fitting of Linear Regression models for prediction.	3
4	Simple problems on Probability. Fitting of Binomial and Poission Distributions, Problems based on Normal Distribution.	4
5	Large Sample Tests for Mean, Variance and Correlation Coefficient. F test, t test for Mean.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Organize different statistical data and present them graphically.	1, 2, 4
	CLO2	Calculate different measures of locations and dispersion.	1, 4
	CLO3	Examine bivariate relationships.	1, 4
	CLO4	Apply the knowledge of probability in agriculture.	1
	CLO5	Conduct different tests with interpret experimental results.	1

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, demonstration	Sessional assessment (Formative: Quiz, objective, active class participation, drill and viva)
CLO2	Lecturing, discussion, demonstration	Sessional assessment (Formative: Quiz, objectives, active class participation, drill and viva)
CLO3	Lecturing, discussion, demonstration	Sessional assessment (Formative: Quiz, objectives, active class participation, drill and viva)
CLO4	Group discussion, demonstration, presentation	Sessional assessment (Formative: Quiz, objectives, active class participation, drill and viva)
CLO5	Group discussion, demonstration, presentation	Sessional assessment (Formative: Quiz, objectives, active class participation, drill and viva)

Recommended Readings	Balakrishnan, N. 2002. Statistical Methods and Practice. Prentice Hall of India. Chakravorthi, S.R. and Giri, N. 2002. Basic Statistics. South Asian Publishers, New Delhi. Cochran, W.G. 1989. Sampling Techniques. Oxford and IBH Publishing Co. Croxton, F.E. and Cowden, D.J. 1966. Applied General Statistics. Prentice Hall of India Pvt. Ltd., New Delhi. Zar, J.H. 2005. Biostatistical Analysis. 4th ed., Pearson Education, India.
Supplementary Readings	Fisher. R.A. 1950. Statistical Methods for Research Workers. 11th ed., Oliver & Boyd, Edinburg. Fisher, R.A. and Yates, F. 1948. Statistical Tables for Biological, Agricultural and Medical Research. Oliver & Boyd, Edinburg. Gupta, S.C. and Kapoor, V.K. 1997. Fundamentals of Mathematical Statistics. Sultan Chand & Sons Publisher, New Delhi. Panse, V.G. and Sukhatme, P.V. 1967. Statistical Methods for Agricultural Workers. ICAR, New Delhi. Rangaswamy, R. 2002. A text book of Agricultural Statistics. John Wiley & Sons. Snedecor, G.W. and Cochran, W.G. 1992. Statistical Methods. Oxford and IBH Publishing Co.

Course Code: 0613 08 CSE 2260		Year: Second	Term: Second
Course Title	Data Base and Statistical Package Sessional		
Course Status	Optional		
Credit	1.5		
Prerequisite(s)	None		
Rationale	This course describes This course is designed to provide basic knowledge on database, input and output designs, data query and analysis of data using statistical package.statistical procedures in agricultural research.		

	Course Contents/Tasks	CLOs
1	Concept on database.	1
2	Input and output designs.	1
3	Data query.	1
4	Analysis of data using statistical packages.	1

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Apply the principles of data base and statistical package.	1, 2, 3, 6, 7, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, tutorial	Written examination, quiz, assignment

Learning Materials

Recommended Readings	McEwan, G.M. 1980. Introduction to Computer System. Mcgraw Hill, USA.
Supplementary Readings	Online resources

Third Year First Term		
Course Code: 0811 08 AT 3101	Year: Third	Term: First

Course Title	Production Technology of Field Crops
Course Status	Core
Credit	3.0
Prerequisite(s)	None
Rationale	Agrotechnology graduates need contemporary knowledge on production technology of different field crops. This course provides information about different determinants affecting crop yield and the production technology of field crops.

	Course Contents	CLOs
	Section A	
1	Yield and yield comments of field crops.	1
2	Factors affecting yield of field crops: Climatic factors: temperature, light, precipitation, humidity, and wind as the determinants of crop yield. Edaphic factors: land topography, temperature, moisture, content of organic matter andsoil elements, soil reaction and soil organisms. Cultural factors: water, fertilizer and pests. Plant factors: phenological characters.	2
3	Production technology of crops in respect of the following: origin, soil, climate, morphology, varieties, land preparation, fertilizer application, planting, seed rate, intercultural operations, harvesting and post-harvest operations. Cereal crops: rice, wheat, maize, Italian millet and common millet, sorghum. Sugar crops: sugar cane. Narcotic crops: tobacco.	3
	Section B	CLOs
4	Production technology of crops in respect of the following: origin, soil, climate, morphology, varieties, land preparation, fertilizer application, planting, seed rate, intercultural operations, harvesting and post-harvest operations. Fibre crops: jute, cotton, mesta and kenaf. Pulse crops: lentil, grass pea, mungbean, fieldpea, chickpea, black gram, pigeon pea, cowpea. Oil seed crops: mustard, peanut, sesame, soybean, linseed, sunflower, safflower, niger. Green manuring crops: dhaincha, sunnhemp.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Compare the yield components of various crops.	1, 2, 5, 11
	CLO2	Assess the influence of climatic, edaphic, cultural and plants factors on crop yield.	1, 2, 3, 5, 11
	CLO3	Describe the improved production technology of different types of agronomic crops (cereal, sugar, narcotic, fibre, pulses, oil seeds, green manuring crops and fodder crops).	1, 2, 3, 5, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, video show	Continuous assessment (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO2	Lecturing, ppt presentation, demonstration, group discussion	Continuous assessment (Formative: Quiz, group work, active class participation) and summative (Term final)
CLO3	Lecturing, video, demonstration, field visit	Continuous assessment (Formative: Objectives, quiz, question-answering, group discussion, presentation) and summative (Term final)

Learning Materials

Recommended Readings	Aiyar, A.K. Y.N. 1975. Principles of Crop Husbandry in India. The Bangalore Printing and Publishing Co. Ltd. Bangalore. Alim. A. 1978. A Handbook of Bangaldesh Jute. Effat Begum, Dhaka. Banerjee, B. 1993. Tea: Production and Processing. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India. Chapman, S.R. and Carter, L.P. 1976. Crop Production-Principles and Practices. Surjeet Pub. New Delhi. Chatterjee, B.N. and Maiti, S. 1979. Principles and Practices of Rice Growing. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.
Supplementary Readings	Chatterjee, B.N. and Maiti. S. 1979. Rice Production Technology Manual. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India. Datta, De and Surajit, K. 1933. Principles and Practices of Rice Production. John Wiley & Sons. New York. Desai, D.K. and Gandhi, M. 1988. Rice: Production, Productivity and Research Management. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi. Kaul, A.K. and Das, M.L. 1986. Oilseeds in Bangladesh. Bangladesh-Canada Agriculture Sector Team. Min. of Ag. GOB. Dhaka. Kipps, M.S. 1978. Production of Field Crops. Tata McGrow Hill Pub. Co. Ltd. New Delhi. Langer, R.H.M. and Hill, G.D. 1991. Agricultural Pant, Cambridge University Press, London. Martin, J.H. and Leonard. W.H. and Stamp, D. L. 1976. Principles of Field Crop Production. Macmillan Pub. Co. Inc. New York, USA. Quddus, M. A. 1985. Bangladesher Khadya Shasha O Arthokariphasal. Bangla Academy, Dhaka. Singh, C. 2002. Modern Techniques of Raising Field Crops Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi. Thakur, C. 1980. Scienctific Crop Production (vol 1 & 2). Metropolition Book Co, Pvt. Ltd., New Delhi. Yadava, R.L. 1991. Sugarcane Production Technology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Course Code: 0811 08 AT 3102	Year: Third	Term: First
Course Title	Production Technology of Field Crops Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	This course is offered to provide practical knowledge on production technology of agronomic crops and their cost-benefit analysis.	

	Course Contents	CLOs
1	Preparation of nursery bed for raising seedling.	1
2	Practising different methods of planting sugarcane.	2
3	Computation of cost of production of important crops.	3
4	Practising green manuring.	4
5	Raising crops in individual plot.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Prepare different types of nursery beds for raising seedlings.	1, 2, 5, 9
	CLO2	Exercise various methods of sugarcane planting.	1, 2, 5, 9
	CLO3	Perform the cost-benefit analysis of important agronomic crops.	1, 2, 3, 9
	CLO4	Prepare green manures from different crops.	1, 2, 3, 5, 9
	CLO5	Grow field crops and solve the problems confronted during the process.	1, 2, 3, 5, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, method demonstration	Sessional assessment (Formative: Manual skill, active class participation and viva)
CLO2	Lecturing, method demonstration	Sessional assessment (Formative: manual skill, active class participation and viva)
CLO3	Lecturing, problem solving, video presentation	Sessional assessment (Formative: Analytical ability, presentation and viva)
CLO4	Lecturing, method demonstration	Sessional assessment (Formative: Manual skill, active class participation and viva)
CLO5	Group work, demonstration	Sessional assessment (Formative: Manual skill, active class participation and viva)

Learning Materials

Recommended Readings	Aiyar, A.K. Y.N. 1975. Principles of Crop Husbandry in India. The Bangalore Printing and Publishing Co. Ltd. Bangalore. Alim. A. 1978. A Handbook of Bangaldesh Jute. Effat Begum, Dhaka. Banerjee, B. 1993. Tea: Production and Processing. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India. Chapman, S.R. and Carter, L.P. 1976. Crop Production-Principles and Practices. Surjeet Pub. New Delhi. Chatterjee, B.N. and Maiti, S. 1979. Principles and Practices of Rice Growing. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.
Supplementary Readings	Chatterjee, B.N. and Maiti. S. 1979. Rice Production Technology Manual. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India. Datta, De and Surajit, K. 1933. Principles and Practices of Rice Production. John Wiley & Sons. New York. Desai, D.K. and Gandhi, M. 1988. Rice: Production, Productivity and Research Management. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi. Kaul, A.K. and Das, M.L. 1986. Oilseeds in Bangladesh. Bangladesh-Canada Agriculture Sector Team. Min. of Ag. GOB. Dhaka. Kipps, M.S. 1978. Production of Field Crops. Tata McGrow Hill Pub. Co. Ltd. New Delhi. Langer, R.H.M. and Hill, G.D. 1991. Agricultural Pant, Cambridge University Press, London. Martin, J.H. and Leonard. W.H. and Stamp, D. L. 1976. Principles of Field Crop Production. Macmillan Pub. Co. Inc. New York, USA. Quddus, M. A. 1985. Bangladesher Khadya Shasha O Arthokariphasal. Bangla Academy, Dhaka. Singh, C. 2002. Modern Techniques of Raising Field Crops Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi. Thakur, C. 1980. Scienctific Crop Production (vol 1 & 2). Metropolition Book Co, Pvt. Ltd., New Delhi. Yadava, R.L. 1991. Sugarcane Production Technology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Course Code: 0811 08 AT 3103		Year: Third	Term: First
Course Title	Agricultural Chemistry		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course intends to familiarize the students with modern manufacturing techniques of agrochemicals (fertilizers and pesticides) and with their fate on the environment.		

	Course Contents	CLOs
	Section A	
1	Introduction: Concept of agricultural chemistry and agrochemicals.	1, 2
2	Manufacturing of fertilizers: Nitrogenous, phosphatic and potassic fertilizers.	1
3	Chemistry of micronutrients: Zinc, copper, iron, manganese, boron etc.	1, 2
4	Properties of fertilizers: Physical and chemical properties; quality control and specifications of commonly used fertilizers; mixed and compound fertilizers; compatibility of fertilizers; advantages and disadvantages of mixed and liquid fertilizers.	2
5	Fate of fertilizers after application: Nitrogenous fertilizers-urea, ammonium sulphate etc.; phosphatic fertilizers- triple superphosphate, single superphosphate etc.; potassic fertilizers- muriate of potash, potassium sulphate etc.	2
	Section B	CLOs
6	Pesticide chemistry: Chemistry of pesticide formulation; chemistry and utilization of carrier materials for pesticide formulation; dust, wettable and water dispersible powders, emulsifiable concentrates; preparation, properties and mode of action of commonly used insecticides, herbicides and fungicides; natural organic compounds, organochlorinated hydrocarbons, organophpsphorus compounds, organocarbamates; effects of pesticides on agro-environment.	2
7	Nuclear chemistry: Nuclear stability, radio-isotopes, interactions of radiation with matter, half-life, radiation units, radiation detection and application of radio-isotipes in agriculture.	3
8	Chemistry and technology of water: Chemistry of water, irrigation water quality, water pollution and treatment.	4
9	Instrumental methods of analysis: Working principles of pH meter conductivity meter, colorimetry, spectrophotometry, and chromatography.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain the manufacturing techniques of synthetic fertilizers and pesticides.	1, 2, 7
	CLO2	Discuss the physical and chemical properties of fertilizers and pesticides and their impact on environment.	1, 6, 9
	CLO3	Elucidate the use of nuclear chemistry in agriculture.	1, 2, 7
	CLO4	Judge the suitability of irrigation water in crop production.	1, 6, 9
	CLO5	Formulate the working principles of various instruments.	1, 2, 7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, brain storming and problem solving	Quiz, class test and final exam
CLO2	Lecture, group discussion, brain storming and problem solving	Presentation, quiz, assignment and final exam
CLO3	Lecture, group discussion, brain storming and problem solving	Class test, viva voce and final exam
CLO4	Lecture, group discussion, brain storming and problem solving	Quiz, assignment, class test and final exam
CLO5	Lecture, group discussion, brain storming and problem solving	Presentation, quiz, class test and final exam

Learning Materials

Recommended Readings	Buchel, K. H. 1977. Chemistry of Pesticides. Johnwiley and Sons Publications, New York. Gupta, A.K. 2007. Methods in Environmental Analysis Water, Soil and Air. 2nd ed., Agrobios, India. Gupta, P.K. 1999. Hand book of Soil, Fertilizer and Manure. Agro Botanica, Bikaner. Mishra, P.C. 1989. Soil Pollution and Soil Organisms. Ashish Publishing House, New Delhi.
Supplementary Readings	Petreezzelli, D. and Hefferich, F.G. 1993. Migration and Fate of Pollutants in Soils and Subsoils. Verlag, New York. Purohit, S.S. 2006. Environmental Pollution Causes, Effects and Control. Agrobios, India. Salt, D.E, Smith, R.D. and Ruskin, I. 1998. Phyto Remediation. Annu Rev. Plant Physical. Plant Mol. Biol. 49: 643 - 68. Shilpa, S, Varma, H.N and Bhargava, S.K. 2006. Air Pollution and its Impacts on Plant Growth. New India Publishing Agency, New Delhi. Singh, S.S. 1999. Soil Fertility and Nutrient Management. Kalyani Publishers, New Delhi.

Course Code: 0811 08 AT 3104		Year: Third	Term: First
Course Title	Agricultural Chemistry Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course intends to provide the students with modern manufacturing techniques of agrochemicals (fertilizers and pesticides) and their fate on the environment.		

	Course Contents/Tasks	CLOs
1	Preparation of plant extract.	1, 2
2	Estimation of N, P, K, Ca, Mg, S from plant extract, fertilizer and water sample.	1
3	Techniques of pesticide formulation.	3
4	Visit to fertilizer factories and pesticide factories.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Make the plant extract to investigate its nutrient status.	1, 2, 7
	CLO2	Estimate N, P, K, Ca, Mg, S from plant extract, fertilizer and water samples.	1, 6, 9
	CLO3	Demonstrate the ideal techniques of pesticide formulation.	1, 2, 7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, hands-on training, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks, and sessional final
CLO2	Lecture, hands-on training, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks, and sessional final
CLO3	Lecture, hands-on training, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks, and sessional final

Learning Materials

Recommended Readings	Buchel, K. H. 1977. Chemistry of Pesticides. Johnwiley and Sons Publications, New York. Gupta, A.K. 2007. Methods in Environmental Analysis Water, Soil and Air. 2nd ed., Agrobios, India. Gupta, P.K. 1999. Hand book of Soil, Fertilizer and Manure. Agro Botanica, Bikaner.
Supplementary Readings	Petreezzelli, D. and Hefferich, F.G. 1993. Migration and Fate of Pollutants in Soils and Subsoils. Verlag, New York. Purohit, S.S. 2006. Environmental Pollution Causes, Effects and Control. Agrobios, India. Salt, D.E, Smith, R.D. and Ruskin, I. 1998. Phyto Remediation. Annu Rev. Plant Physical. Plant Mol. Biol. 49: 643 - 68. Shilpa, S, Varma, H.N and Bhargava, S.K. 2006. Air Pollution and its Impacts on Plant Growth. New India Publishing Agency, New Delhi. Singh, S.S. 1999. Soil Fertility and Nutrient Management. Kalyani Publishers, New Delhi.

Course Code: 0811 08 AT 3105		Year: Third	Term: First
Course Title	Insect Physiology and Ecology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	Introductory Entomology/ Zoology		
Rationale	The course intends to provide the students with advanced knowledge of different crucial insect physiological systems and ecological aspects.		

	Course Contents	CLOs
	Section A	
1	Digestive system and nutrition: Concept, structure and functions of digestive system and its organelles, different types of insect digestive systems, nutritional requirements and metabolism of carbohydrate, fat and proteins in insects, digestion, absorption and assimilation of ingested food molecules.	1
2	Circulatory system: Fundamentals, components and functions of insect haemolymph; structure, major apparatuses and functions of insect circulatory system, mechanism of haemolymph circulation in haemocoel.	1
3	Excretory system: Elementary knowledge to excretion, structure and functions of organs (Malphigian tubules, fat body, nephrocytes and urate cells) associated with excretion in insects, significance of excretion in arthropods.	1
4	Respiratory system: Fundamentals and classification (polyneustic and apneustic respiratory systems), mechanism of respiration, structure and functions of respiratory system in terrestrial insect; means of respiration in aquatic and endoparasitic insects.	2
5	Nervous system: Characteristics and classification, physiology, types of neurons based on polar and functions, synapse structure and types, structures and functions of central, peripheral and sympathetic nervous system, significance.	2
6	Sense organ: Structures, distribution and functions of mechanoreceptor, chemoreceptor, photoreceptor, auditory organ, temperature and humidity receptor, their necessities, relationship of sense organ with nervous system.	2
	Section B	CLOs
7	Endocrine glands: Characteristics and functions of endocrine glands and hormones; types of endocrine glands and their secreted hormones, sketch of endocrine glands with their corresponding positions and functions; physiology and hormonal control in insects, hormonal significance in insect growth, development and reproduction.	3
8	Insect reproduction and embryology: Concepts; structure and functions of insect reproductive system and their components, types of reproduction and their significances, reproductive behavior, mating strategies, sexual selection of insect, embryogenesis, segmentation and their necessity in reproduction.	3
9	Insect ecology: Fundamentals, insect population dynamics, role of biotic and abiotic factors on the population dynamics of insects, structure of agroecosystem, ecological niche, insect natality and mortality, insect tropism, insect dispersal and dispersion pattern, their types and significance, insect association and their types, insect diapauses, hibernation and aestivation along with their importance in survival.	4
10	Growth form: Elementary knowledge, classification, basic features of different types of growth forms and their significance in agroecosystem.	5
11	Polymorphism: Concepts, significance, types (sexual dimorphism and allelic polymorphism, geographical polymorphism, seasonal polymorphism, environmental polymorphism, mimicry, crypsis, industrial melanism, phenotypic plasticity, reaction norm and so forth, their adaptation in agroecosystem.	5

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Discuss the mechanisms of insect digestive, excretory and blood circulatory systems and categorize their organelles upon their functions and significancein maintaining homeostasis.	1, 2, 7
	CLO2	Analyze the role of key apparatuses associated with insect respiration, nervous systems and sense organs in responding external and internal stimuli.	1, 6, 9
	CLO3	Compare and contrast among different endocrine glans associated with hormonal secretion and varying types of insect reproduction.	1, 2, 7
	CLO4	Appraise the impact of biotic and abiotic factors on the population dynamics as well as explain insect tropism, dispersal and dispersion pattern and diapause.	1, 2, 6
	CLO5	Compare different types of insect growth forms and polymorphism and analyze the contribution and importance in agroecosystem.	1, 2, 7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, brain storming and problem solving	Quiz, class test and final exam
CLO2	Lecture, group discussion, brain storming and problem solving	Presentation, quiz, assignment and final exam
CLO3	Lecture, group discussion, brain storming and problem solving	Class test, viva voce and final exam
CLO4	Lecture, group discussion, brain storming and problem solving	Quiz, assignment, class test and final exam
CLO5	Lecture, group discussion, brain storming and problem solving	Presentation, quiz, class test and final exam

Learning Materials

Recommended Readings	Jurenka, R. 2019. Advances in Insect Physiology. Elsevier, Amsterdam, Netherlands. Nation, J.L. 2008. Insect Physiology and Biochemistry, 2nd ed. CRC Press, Routledge, Taylor and Francis, New York, United States. Wigglesworth, V.B.1984. Insect Physiology, 8th ed. Springer, Amsterdam, Netherlands. Gour, T.B. and Sriramulu, M. 2013. Insect physiology: principles and concepts, 2nd ed. Kalyani Publishers, India. Price, P.W., Denno, R.F., Eubanks, M.D. and Finke, D.L. 2011. Insect Ecology: Behavior, Populations and Communities. Cambridge University Press, UK.
Supplementary Readings	https://genent.cals.ncsu.edu/bug-bytes What is Biological Control? (cornell.edu) Biological Control of Insect Pest | IntechOpen Plant Resistance to Insects (agriculturistmusa.com) Pests & Diseases | Plantix Biological Pest Control - Definition, Types and Examples (vedantu.com) Method/Techniques in Biological Control (imp. center) Mycorrhizal Fungi Powder | Trusted Manufacturer and Global Exporter (indogulfbioag.com) https://organicwayfarming.com/pest-and-disease Schowalter, T. 2022. Insect Ecology: An Ecosystem Approach. Elsevier, Amsterdam, Netherlands. Rai, A.K., Kumar, R. and Kumar, N. 2021. Insect Ecology: Concepts. New Delhi Publisher. Freeman, B. 2021. Ecological and Economic Entomology: A Global Synthesis. CABI.

Course Code: 0811 08 AT 3106		Year: Third	Term: First
Course Title	Insect Physiology and Ecology Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	Introductory Entomology andInsect Ecology Sessional Knowledge		
Rationale	The course intends to provide hands-on experience on dissecting insects various physiological systems and assessing the ecological impact on insect population dynamics.		

	Course Contents/Tasks	CLOs
1	Dissect and identify different organelles of inset digestive, nervous, sensory and reproductive system.	1
2	Identify major insect vectors and evaluate their ecological significance in disease transmission.	1
3	Estimate economic injury and action thresholds of different insects infesting agricultural crops.	2
4	Estimation of insect population dynamics in an agroecology.	
5	Determine the effects of ecological biotic and abiotic factors on insect population growth.	2
6	Field trips.	1, 2, 3, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Collect, prepare and dissect insect specimens to identify key apparatuses of insect alimentary canal, respiratory spiracle and trachea, sensory organ, neurons of nervous system, and reproductive system.	1, 2, 4, 9
	CLO2	Calculate EIL (economic injury level) and ETL (economic threshold level) as well as demonstrate how vector insects transmit plant diseases.	1, 4, 7, 9
	CLO3	Measure insect population growth (positive/ negative) in an agroecosystem and figure out the causes influencing insect population dynamics.	1, 4, 7, 9
	CLO4	Determine the correction between insect ecology and biology.	1, 2, 7, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, hands-on training, group discussion, and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO2	Lecture, group discussion, hands-on training and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO3	Lecture, hands-on training, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO4	Lecture, group discussion, hands-on training, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final

Learning Materials

Recommended Readings	Jurenka, R. 2019. Advances in Insect Physiology. Elsevier, Amsterdam, Netherlands. Nation, J.L. 2008. Insect Physiology and Biochemistry, 2nd ed. CRC Press, Routledge, Taylor and Francis, New York, United States. Wigglesworth, V.B.1984. Insect Physiology, 8th ed. Springer, Amsterdam, Netherlands. Gour, T.B. and Sriramulu, M. 2013. Insect physiology: principles and concepts, 2nd ed. Kalyani Publishers, India. Price, P.W., Denno, R.F., Eubanks, M.D. and Finke, D.L. 2011. Insect Ecology: Behavior, Populations and Communities. Cambridge University Press, UK.
Supplementary Readings	https://genent.cals.ncsu.edu/bug-bytes What is Biological Control? (cornell.edu) Biological Control of Insect Pest | IntechOpen Plant Resistance to Insects (agriculturistmusa.com) Pests & Diseases | Plantix Biological Pest Control - Definition, Types and Examples (vedantu.com) Method/Techniques in Biological Control (imp. center) Mycorrhizal Fungi Powder | Trusted Manufacturer and Global Exporter (indogulfbioag.com) https://organicwayfarming.com/pest-and-disease Schowalter, T. 2022. Insect Ecology: An Ecosystem Approach. Elsevier, Amsterdam, Netherlands. Rai, A.K., Kumar, R. and Kumar, N. 2021. Insect Ecology: Concepts. New Delhi Publisher. Freeman, B. 2021. Ecological and Economic Entomology: A Global Synthesis. CABI.

Course Code: 0811 08 AT 3107		Year: Third	Term: First
Course Title	Production of Spices and Plantation Crops		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide knowledge on basics of spices and plantation crops and to acquaint the students with the production, processing and management of these crops.		
Course Objectives	To grow expertise in students on production and management of spices and plantation crops.		

	Course Contents	CLOs
	Section A	
1	Introduction: Background, status of production and export, importance, scope and associated problems of spices production in Bangladesh.	1, 2
2	Common spices of Bangladesh: Classification, nomenclature, morphology and growth habit of different spice crops of Bangladesh.	3
3	Ecological factors affecting spices production: Role of temperature, light, air water and soil on the growth and development of spices crops.	4
4	Production and processing of spices and condiments: Soil, climate, varieties, land preparation, fertilizer application, sowing time, sowing techniques, seed rate, water management, control of weed, insect and diseases, harvest and post-harvest operations of ginger, turmeric, chilli, garlic, cumins, black pepper, bayleaf, onion, cinnamon and coriander.	5
5	Seed production of spices: Present status and constraints; production and storage of quality seeds of different spices.	5
	Section B	CLOs
6	Introduction: Definition and nomenclature of plantation crops, importance, problems and scope of cultivation of plantation crops in Bangladesh, present scenario of plantation area and crops in the world.	1, 2
7	Ecological factors of plantation crops: Distribution of plantation crops of Bangladesh, Soil, climatic and socio-economic factors affecting production of major plantation crops in Bangladesh and in the world.	3
8	Management aspects of plantation crops: Site selection, land development, planting, intercultural operations and other management practices of plantation crops.	4
9	Production and processing of major plantation crops: Detail study of the following plantation crops with emphasis on biology, soil, climate, varieties, methods of propagation, planting, manuring and fertilization, irrigation and drainage and other intercultural operations, diseases and insect control, harvesting, processing, storage and marketing- tea, rubber, coffee, oil palm, betel leaf, betel nut, bamboo and cocoa.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify and classify spices and plantation crops.	1, 2
	CLO2	Evaluate the importance, scopes and problems of these crops.	3, 4
	CLO3	Describe the spices and plantation crops in respect of the morphological features.	2, 9
	CLO4	Analyze the effects of ecological factors on spices and plantation crops.	2, 4, 9
	CLO5	Explain the production and management practices of spice and plantation crops.	2, 3, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and group discussion, assignment	Formative (Quiz, objectives, active class participation) and summative
CLO2	Lecture, video demonstration and discussion	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstrationfield visit, group discussion	Formative (objectives, quiz, question-answering, presentation) and summative
CLO4	Lecturing, group discussion, demonstration, presentation, field visit, report writing	Formative (objectives, quiz, short questions, MCQ, presentation) and summative
CLO5	Lecturing, video demonstration, presentation, assignment, field visit, assignment	Formative (viva, quiz, short questions, MCQ, presentation) and summative

Learning Materials

Recommended Readings	Thompson, H.C. and Kellay, W.C. 1957. Vegetable crops. McGraw-Hill Boob Company, London. Department of Agricultural Extension (DAE) 1995. Training manual Summer and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE.
Supplementary Readings	Department of Agricultural Extension (DAE) 1995. Training manual Winter and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE.

Course Code: 0811 08 AT 3108	Year: Third	Term: First
Course Title	Production of Spices and Plantation Crops Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	Practical knowledge on cultivation practices for spices and plantation crops are supposed to be taught in this course to develop skills on management issues of these crops.	
Course Objectives	To enable the students in handling different perspectives of spices and plantation crops.	

	Course Contents/Tasks	CLOs
1	Identification of seeds and seedlings of spices and plantation crops.	1
2	Estimation of seed rate and fertilizer dose for different spices and plantation crops.	2
3	Methods of planting spices: sowing, dibbling and transplanting.	3
4	Study of the important morphological features related to production of some important spices and plantation crops.	1
5	Seed processing technique in onion, turmeric, garlic and black pepper.	3
6	Cultivation of spices in plot and report writing.	3
7	Album preparation of different seeds and seedlings of spices and plantation crops.	1
8	Estimation of cost of cultivation of important spices.	2
9	Visiting important plantation areas of Bangladesh.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify the seeds and seedlings of spices and plantation crops.	1, 2
	CLO2	Estimate the rate of seed, fertilizer and cost of cultivation for spices and plantation crops.	1, 2, 3, 5, 9
	CLO3	Demonstrate cultural practice, production and processing techniques for growing spices and plantation crops.	1, 2, 3, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration and group discussion, assignment	Formative (Quiz, performance evaluation, active class participation) and summative
CLO2	Lecture, video demonstration and calculation	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstration, field visit, group discussion, report writing	Formative (Objectives, quiz, question-answering, presentation) and summative

Learning Materials

Recommended Readings	Bose, T. K., Kabir, J., Maity, T. K., Parthasarthy, V. A. and Son, M. G. (eds.) 2003. Vegetable Crops. Naya Udyog. Kolkata, India. Evans, J. 1996. Plantation Forestry in the Tropics. 2nd ed., Clarendon Press, Oxford. Weiss. 2002. Spice Crops. CABI Publishing, UK. Pruthi, J. S. 1998. Spices and Condiments. 5th ed., National Book Trust, India. Sana, D. L. 1989. Tea Science. Ashrafia Boi Ghar, Dhaka, Bangladesh.
Supplementary Readings	Kumar, N., Kader, M.A., Rangaswami, P. and Irulappan, I. 1997. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford and IBH Pub. Co., India. Wilson, K.C. 1999. Coffee, Cocoa and Tea. CABI Publishing. Wallingford, UK. Department of Agricultural Extension (DAE) 1995. Training manual Summer and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE. Department of Agricultural Extension (DAE) 1995. Training manual Winter and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE.

Course Code: 0811 08 AT 3109		Year: Third	Term: First
Course Title	Agroforestry and Social Forestry		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	Agroforestry and social forestry are two integral parts of Bangladesh's agricultural practices. This course intends to provide knowledge and concept on practices of agroforestry and social forestry in the world and in Bangladesh.		

	Course Contents	CLOs
	Section A: Agroforestry	
1	Definition and concept: Concept, characteristics, classification, potentials and constraints of agroforestry; distribution of agroforestry systems and practices in the tropics and subtropics, history of agroforestry in Bangladesh.	7
2	Agroforestry planning: Biophysical and socio-economic survey by diagnosis and design method; evaluation of species adaptability for agroforestry systems. Examples of different agroforestry and social forestry designs along with their features and suitability.	1
3	Agroforestry species: Concept of multipurpose tree species (MPTs); role of multipurpose trees and shrubs in agroforestry development; limitations in the use of multipurpose trees and shrubs; management of multipurpose trees.	2, 4
4	Component interactions and soil productivity: Positive and negative interactions, component management, effects of trees on soil- positive and negative effects, nutrient cycling in agroforestry land use system.	3, 5
5	Agroforestry practices: Current agroforestry practices in Bangladesh and other SAARC countries, and in other developing countries of the world.	6
6	Quantification of benefits in agroforestry: Interactions between trees and crops in agroforestry land use system.	3
	Section B: Social Forestry	CLOs
7	Introduction to social forestry: Concept and synonyms of social forestry, comparison among conventional forestry, social forestry and agroforestry; characteristics, objectives, requisites and types of social forestry.	7, 8
8	Elements and environmental aspects of social forestry: Social forestry as a resource system and development program, physical and socio-economic environment, social and environmental aspects of social forestry; impacts of social forestry.	9
9	Planning and evaluation: Orientation with major social forestry projects in Bangladesh. Planning and evaluation of important social forestry projects and their contribution in agricultural and rural development.	10
10	Social forestry in Bangladesh: Scope, status and constraints: factors influencing the adoption of social forestry.	11
11	Women in social forestry: Need for involving women in social forestry, constraints of women involvement in social forestry in Bangladesh.	12

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Use design and diagnosis methods to identify agroforestry solutions for local problems.	3
	CLO2	Evaluate different spices for the agroforestry system.	4
	CLO3	Assess productivity for an agroforestry system.	5
	CLO4	Evaluate the importance of multipurpose tree species.	5
	CLO5	Compare the interactions among different components of an agroforestry system.	2
	CLO6	Comprehend the agroforestry practices in Bangladesh and SAARC countries.	7
	CLO7	Compare among agroforestry, social forestry and traditional forestry.	1
	CLO8	Identify the elements of social forestry.	1
	CLO9	Conceptualize environmental aspects of social forestry.	2
	CLO10	Interpret the scope, status and constraints of social forestry in Bangladesh.	1
	CLO11	Identify the factors affecting adoption of social forestry.	1
	CLO12	Evaluate the needs and constraints of women involvement in social forestry in Bangladesh.	3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Quiz and class test
CLO5	Lecturing, discussion	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecture and team teaching	Quiz and class test
CLO8	Problem-based learning and presentation	Assignment and final exam
CLO9	Lecture and group discussion	Viva voce and final exam
CLO10	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Quiz and class test
CLO11	Lecturing, discussion	Assignment and final exam
CLO12	Lecture and group discussion	Viva voce and final exam

Learning Materials

Recommended Readings	Ahmed, M.R. 1991. Social Forestry: Theories, Concepts and Applications. Paper presented at the seminar on "Management of Social Forestry Projects" held on Feb. 17-20, 1991. in Dhaka. Organized by World Food Programme. Bandyopadhyay, A.K. 1997. A TextBook of Agroforestry with Applications. Vikas Publishing House Pvt. Ltd. New Delhi. Dwivedi, A.P. 1992. Agroforestry – Principles and Practices. Oxford & IBH Pub. Co. Ltd. New Delhi.
Supplementary Readings	Agroforestry.org - Agroforestry Books Relevant other books/study materials would be provided by the Course Instructor.

Course Code: 0811 08 AT 3110		Year: Third	Term: First
Course Title	Agroforestry and Social Forestry Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course intends to impart practical knowledge on agroforestry species identification, homestead gardening; agroforestry and social forestry practices so that the students acquire practical skills in agroforestry and social forestry.		

	Course Contents/Tasks	CLOs
1	Identification of Multipurpose Trees (MPTs).	1
2	Studies on Silvan Features and use of different MPTs of Bangladesh.	2
3	Preparation of nursery for raising saplings of different trees.	3
4	Field study of homestead garden.	4
5	Study on forest-based agriculture system.	5
6	Pictorial presentation of different agroforestry practices like home-garden, alley cropping, boundary plantation, living fence, wind break, etc.	5
7	Field trips to different agroforestry and social forestry projects, preparation and submission of reports.	1, 5, 6

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify important agroforestry species.	4
	CLO2	Demonstrate silvan features of important MPTS.	2
	CLO3	Prepare nursery and raise saplings of agroforestry species.	5
	CLO4	Design and construct ideal homestead garden.	9
	CLO5	Recognize important forest species for an agroforestry system.	4
	CLO6	Recommend agroforestry practices through pictorial presentation.	4

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation
CLO5	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation
CLO6	Lecturing, discussion, video presentation, demonstration, field visit, report writing	Assignment, quiz, presentation

Learning Materials

Recommended Readings	Ahmed, M.R. 1991. Social Forestry: Theories, Concepts and Applications. Paper presented at the seminar on "Management of Social Forestry Projects" held on Feb. 17-20, 1991. in Dhaka. Organized by World Food Programme. Bandyopadhyay, A.K. 1997. A TextBook of Agroforestry with Applications. Vikas Publishing House Pvt. Ltd. New Delhi. Dwivedi, A.P. 1992. Agroforestry – Principles and Practices. Oxford & IBH Pub. Co. Ltd. New Delhi.
Supplementary Readings	Agroforestry.org - Agroforestry Books Relevant other books/ study materials would be provided by the Course Instructor.

Course Code: 0811 08 AT 3111		Year: Third	Term: First
Course Title	Irrigation and Water Management		
Course Status	Optional		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is aimed to provide knowledge on various issues of irrigation and water management for better crop production.		

	Course Contents	CLOs
	Section A	
1	Development of irrigation and irrigated agriculture in Bangladesh: Irrigation, importance of irrigation water to plants; irrigation systems and present state of development; performance of irrigated agriculture; irrigation water conveyance and distribution systems; irrigation status of different crops; common problems in irrigated agriculture and their remedies.	1
2	Water application methods: Methods of water application, irrigation water loss and its management; Irrigation management of crop in problem soil: rain water harvesting.	2
3	Irrigation efficiencies: Efficiency of water conveyance, application, storage, distribution, use and consumptive use.	2
4	Crop-water production functions: Crop-water production functions and their uses; yield response to water stress; system water requirement vs management level.	2, 3
5	Irrigation water quality: Classification and effects on soil properties.	4
	Section B	CLOs
6	Irrigation scheduling and water requirement: Concept; calculation of irrigation water requirements of corps.	3
7	Water management practices for crops: Cereal crops, non-cereal food crops, vegetables and fruit trees.	3
8	Drainage of agricultural lands: Definition, benefits, drainage problems, evaluating the drainage requirement, site selection and preparation of land, design of drainage systems, types of drainage systems, drainage coefficient.	3
9	Measurement of irrigation water: Units and methods of measurement.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Justify the chronology of irrigation development and irrigated agriculture in Bangladesh.	1, 2
	CLO2	Compare different water application methods.	1, 2, 3, 5
	CLO3	Design appropriate water management strategy.	1, 2
	CLO4	Relate quality of irrigation water with soil properties.	1, 2
	CLO5	Measure irrigation water.	1, 2, 3, 5, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, demonstration	Continuous assessment (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO2	Lecturing, video, demonstration, field visit	Continuous assessment (Formative: Quiz, assignment, objective, question-answering, problem solving, active class participation) and summative (Term final)
CLO3	Lecturing, group discussion, presentation, debate, assignment	Continuous assessment (Formative: Objectives, quiz, question-answering, group discussion, presentation) and summative (Term final)
CLO4	Lecturing, group discussion, presentation, case study	Continuous assessment (Formative: Short questions, presentation) and summative (Term final)
CLO5	Lecturing, discussion, problem analysis	Continuous assessment (Formative: Short questions, problem solving) and summative (Term final)

Learning Materials

Recommended Readings	F.A.O. 1977. Crop Water Requirements. F.A.O. Irrigation and Drainage Paper No. 24. Hansen, V.F., Israelsen, O.W., and Stringham, U.E. 1979. Irrigation Principles and Practices, 4th ed. John Wiley and Sons. New York. Toronto. Luthin, J.N. 2015. Drainage Engineering. Scientific Publisher.
Supplementary Readings	Michael, A.M. 1996. Irrigation Theory and Practice. Vikas Publishing House Pvt. Ltd., New Delhi. Misra, R.D., and Ahmed, M. 1993. Manual on Irrigation Agronomy. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. Sharma, S.K. 1988. Principles and Practices of Irrigation Engineering. S. Chand and Company Pvt. Ltd., New Delhi.

Course Code: 0811 08 AT 3112		Year: Third	Term: First
Course Title	Irrigation and Water Management Sessional and Fieldwork		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course is planned to describe applied issues about water application strategies, water quality assessment, and measurement of soil moisture and irrigation water.		

	Course Contents/Tasks	CLOs
1	Determination of soil moisture content by gravimetric method, tensiometric method and feel method.	1
2	Field capacity determination by saturation-drainage method.	1
3	Layout of different irrigation methods.	2
4	Measurement of irrigation water.	1
5	Calculation of irrigation water use efficiency.	2
6	Calculation of crop water requirement, irrigation water requirement and drainage requirement.	3
7	Determination of EC, pH, carbonates, bicarbonates, Na+, Ca++, Mg++ and Cl- in irrigation water.	4
8	Visit to irrigation and drainage projects.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Determine soil moisture content and measure irrigation water.	1, 2, 5, 8, 9, 10
	CLO2	Drill irrigation methods and compute irrigation efficiencies.	1, 2, 3, 9, 10
	CLO3	Calculate crop water requirement and irrigation water requirement.	1, 2, 3, 8, 9, 10
	CLO4	Determine irrigation water quality.	1, 2, 5, 8, 9, 10
	CLO5	Value with irrigation and drainage projects.	1, 5

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, problem exercise, discussion, demonstration, field visit	Sessional assessment (Formative: Active class participation, problem analysis and viva)
CLO2	Lecturing, problem exercise, method demonstration, field visit, assignment	Sessional assessment (Formative: Manual skill, active class participation and viva)
CLO3	Lecturing, problem exercise	Sessional assessment (Formative: Active class participation, problem analysis and viva)
CLO4	Demonstration, problem analysis	Sessional assessment (Formative: Laboratory analysis and viva)
CLO5	Field visit, study tour	Sessional assessment (Formative: Report preparation and viva)

Learning Materials

Recommended Readings	F.A.O. 1977. Crop Water Requirements. F.A.O. Irrigation and Drainage Paper No. 24. Hansen, V.F., Israelsen, O.W. and Stringham, U.E. 1979. Irrigation Principles and Practices, 4th ed. John Wiley and Sons. New York. Toronto. Luthin, J.N. 2015. Drainage Engineering. Scientific Publisher.
Supplementary Readings	Michael, A.M. 1996. Irrigation Theory and Practice. Vikas Publishing House Pvt. Ltd., New Delhi. Misra, R.D. and Ahmed, M. 1993. Manual on Irrigation Agronomy. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. Sharma, S.K. 1988. Principles and Practices of Irrigation Engineering. S. Chand and Company Pvt. Ltd., New Delhi.

Course Code: 0511 08 AT 3113		Year: Third	Term: First
Course Title	Molecular Biology		
Course Status	Optional		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is intended to provide fundamental and applied knowledge about the molecular structure of genes and their ultimate functions in the determination of the phenotype of organisms.		

	Course Contents	CLOs
	Section A	
1	Introduction: Principles, materials and methods, importance, and historical development in molecular biology.	1
2	Identification of the genetic materials: Evidence for DNA and RNA as genetic material.	1, 2
3	Chemical nature of genetic materials: DNA-molar ratios of nitrogen bases in DNA molecule; physical, molecular, or geometrical organization of DNA; Watson and Crick's structural model of DNA, replication of DNA; enzymes of DNA metabolism. RNA-molecular structure of RNA; replication of genetic RNA.	2
4	Genetic code: Basis of cryptoanalysis; methods of cryptoanalysis of genetic code- in vitro and in vivo codon assignments; characteristics of triplet codon.	2
5	Non-genetic ribonucleic acid: Chemical composition of non-genetic ribonucleic acid; comparison between DNA replication and transcription, RNA-polymerase enzymes; RNA synthesis and chain termination; types of non-genetic RNA.	3
	Section B	CLOs
6	Biosynthesis of proteins: Central dogma and central dogma reverse; components of protein synthetic machinery- amino acid, DNA, non-genetic RNAs, ribosomes and enzymes, other functions of ribosomes; mechanisms of protein synthesis on 70s ribosomes and on 80s ribosomes.	3
7	Regulation of gene action in prokaryotes: Enzyme regulation of gene action; gene regulation of gene action (regulatory genes).	4
8	Control of gene expression in eukaryotes: Short-term genetic regulations in simple and complex eukaryotes; mechanism of short-term hormonal regulation; short-term regulation by histones, acidic proteins, heterochromatinization, heterogenous nuclear RNA, and post-transcriptional mechanism; long-term genetic regulation in complex eukaryotes-gene regulation during 00genesis and cellular differentiation.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Analyze the role of molecular biology and technology in agriculture.	2
	CLO2	Interpret the outcome of experiments that involve DNA and RNA as genetic material and describe their chemical and physical structures.	2, 3
	CLO3	Explain the mechanisms of DNA replication and repair, RNA synthesis and processing, and protein synthesis.	3
	CLO4	Describe how gene expression is regulated at the transcriptional and post-transcriptional level.	2, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion	Written examination, quiz, assignment, presentation
CLO2	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment, presentation
CLO3	Lecture, assignment and presentation, group discussion, tutorial	Written examination, quiz, assignment, presentation
CLO4	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment, presentation

Learning Materials

Recommended Readings	De Robertis, E.D.P and De Robertis, E.M.F.Jr. 1999. Cell and Molecular Biology, B.I. Publication Pvt. Ltd. New Delhi. Gangawane, L.V. and Khilare V.C., 2010. Molecular Biology of Plant Pathogens, Dya publishing House, new Delhi. Kafmanf, B. 2013. Molecular Biology of Cell. Random Exports, New Delhi, India. Monroe, W.S. 2002. Genetics. Prentice- Hall of India Private Limited, New Delhi. Sambamurty, A.V.S.S. 2007. Molecular Genetics. Narosa Publishing House pvt. ltd. New Delhi.
Supplementary Readings	Sing, B. 2006. Molecular Biology and Biotechnology, Avishkar Publishers, Distributors, Jaipur, India. Singh, B.D. 2004. Genetics. Kalyani Publishers, New Delhi. Stent, G.S. and Calendar, R. 2004. Molecular Genetics: An Introductory Narrative. CBS Publishers & Distributors, New Delhi. Verma, P.S. and Agarwall, V.K. 1999. Concept of Molecular Biology, S. Chand & Company Ltd. New Delhi. Verma, P.S. and Agarwall, V.K. 2005. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd. New Delhi. Verma, P.S. and Agarwall, V.K. 2009. Molecular Biology, S. Chand & Company Ltd. New Delhi.

Course Code: 0511 08 AT 3114		Year: Third	Term: First
Course Title	Molecular Biology Sessional		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide fundamental and practical knowledge to on tools, methods, and techniques of molecular studies and molecular structure of genes and their ultimate functions in the determination of the phenotype of the organisms.		

	Course Contents/Tasks	CLOs
1	Isolation of genetic materials: DNA and RNA.	1, 2
2	Quantification of DNA and RNA.	2
3	PCR technique.	3
4	Restriction analysis of DNA: digestion of DNA and agarose gel electrophoresis.	4
5	Southern blotting, Northern blotting and Western blotting.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Handle different sophisticated instruments required for molecular analysis.	11
	CLO2	Isolate, purify and quantify DNA and RNA from plant materials.	9, 12
	CLO3	Apply the agarose gel electrophoresis technique to make DNA profile.	2, 9, 11, 12
	CLO4	Digest DNA with a restriction endonuclease.	2, 9, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, video clip, hands on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO2	Lecture, demonstration, video clip, hands on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO3	Lecture, demonstration, video clip, hands on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO4	Lecture, demonstration, video clip, hands on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce

Learning Materials

Recommended Readings	De Robertis, E.D.P and De Robertis, E.M.F.Jr. 1999. Cell and Molecular Biology, B.I. Publication Pvt. Ltd. New Delhi. Gangawane, L.V. and Khilare V.C., 2010. Molecular Biology of Plant Pathogens, Dya publishing House, new Delhi. Kafmanf, B. 2013. Molecular Biology of Cell. Random Exports, New Delhi, India. Monroe, W.S. 2002. Genetics. Prentice- Hall of India Private Limited, New Delhi. Sambamurty, A.V.S.S. 2007. Molecular Genetics. Narosa Publishing House pvt.ltd. New Delhi.
Supplementary Readings	Sing, B. 2006. Molecular Biology and Biotechnology, Avishkar Publishers, Distributors, Jaipur, India. Singh, B.D. 2004. Genetics. Kalyani Publishers, New Delhi. Stent, G.S. and Calendar, R. 2004. Molecular Genetics: An Introductory Narrative. CBS Publishers & Distributors, New Delhi. Verma, P.S. and Agarwall, V.K. 1999. Concept of Molecular Biology, S. Chand & Company Ltd. New Delhi. Verma, P.S. and Agarwall, V.K. 2005. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd. New Delhi. Verma, P.S. and Agarwall, V.K. 2009. Molecular Biology, S. Chand & Company Ltd. New Delhi.

Course Code: 0611 08 CSE 3160		Year: Third	Term: First
Course Title	Information Communication Technology in Agriculture Sessional and Fieldwork		
Course Status	Optional/ Elective		
Credit	2.0		
Prerequisite(s)	None		
Rationale	The course intends to acquaint the students with scope of ICT in agriculture, networking and communication media.		

	Course Contents/Tasks	CLOs
1	Information Technology (IT) and its use: Concept, components and types of the information system; Telecommunications and its use in technology diffusion. Role of fax, email, internet, and website in the assimilation and dissemination of technological innovations. Electronic computer basics- hardware, software, types of computers (microcomputer, minicomputer, mainframe computer, and supercomputer).	1
2	Methods of ICT-based communication: Meaning and function. Forms of communication. Role of mass media in the dissemination of farm technology. Moderncommunication media: electronic video, tele text, tele conference, computer-assisted instruction. Digital tools and agricultural research, and extension and advisory services. E-learning and education in agriculture.	2, 3, 4
3	Telephone/mobile technology: Farmer call centre, SMS Broadcast Service, e-krishi, FIAC, kiosk, m-krishi. ICT initiatives of NGOs and private companies. ICT initiatives by DAE and AIS, Value added services.	4
4	Increasing crop and livestock Productivity Through ICT: Achieving good farming practices through use of ICT for improved soil, nutrient, and land management. Preventing yield losses through proper planning and early warning systems	1
5	ICT applications for agricultural risk management: ICT applications for mitigating agricultural risk. ICT applications to transfer agricultural risk. ICT applications for coping with agricultural risk	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Gain concepts of the different communication processes, information models and tools.	5
	CLO2	Become the efficient users of digital tools for technology transfer.	2, 6
	CLO3	Use ICT for risk reduction and management.	7
	CLO4	Become efficient users of IT devices.	11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Problem-based learning and presentation	Assignment and final exam

Learning Materials

Recommended Readings	Ray, G.L. 2006. Extension communication and management. Kalyani Publ. Sandhu, A.S. 2004. Text book on Agricultural communication process and methods. Oxford & TBH. Saravanan, R., Kathiresan, C. and Devi, T.I. 2011. Information & communicationtechnology for agriculture and rural development. New India Publ. Agency.
Supplementary Readings	World Bank. 2017. World Development Report 2018: Learning to Realize Education's Promise. Retrieved from https://openknowledge.worldbank.org/handle/10986/27526 Saravanan, R. 2010. ICTs for agricultural extension. New India Publ. Agency. Jirli, B., Deepak De, & Kendadamth, G.C. 2005. Information and communication technology (ICT) and sustainable development. Ganga Kaveri Publ. House, Varanasi. ISBN 8185694478. Meera, S. N. 2008. ICTs in agricultural extension: Tactical to practical. Ganga Kaveri Publ. House, Varanasi. World Bank. (n.d.). ICT in Agriculture (Updated Edition): Connecting Smallholders to Knowledge, Networks, and Institutions. Retrieved from https://openknowledge.worldbank.org/handle/10986/27526

Third Year Second Term			
Course Code: 0811 AT 3201		Year: Third	Term: Second
Course Title	Principles of Plant Pathology and Diseases of Field Crops		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is designed to provide an orientation regarding disease cycle, mechanism of disease development, epidemiology and management of diseases with special reference to field crops.		

	Course Contents	CLOs
	Section A	
1	Pathogenesis: Parasitism and pathogenicity; chain of events in disease developments; toxins in disease development; pathogenic effects on physiological functions of plant.	1
2	Dissemination of plant pathogens: Importance, factors and mechanisms, epidemiology; pathogen, host and environmental factors in disease development; predisposition.	2, 3
3	Methods of plant disease control: Cultural, legislative, chemical, host resistance, biological agents, integrated approach-concepts, components and economics	4
	Section B	CLOs
4	Diseases of field crops Cereals: Rice, Wheat, Maize, Barley, Millets. Fibres: Jute, Cotton. Pulses: Pea, Gram, Lentil, Blackgram, Mungbean, Grasspea, Pigeonpea. Oilseeds: Mustard, GroundnutSesame, Soybean, Sunflower, Sugar Crops: Sugarcane and Sugar beets.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	State sequential events in disease development and the effects of toxin in disease development.	1
	CLO2	Evaluate the effects of pathogens on the host physiology and mechanism of dissemination of plant pathogens.	1, 5
	CLO3	Judge different factors of epidemic in disease development.	1, 9, 10
	CLO4	Suggest and compare different methods of plant disease control.	1, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, group discussion, presentation, assignment, specific disease case study, video	Quiz, assignment, active class participation, sudden test question and class test, and final exam
CLO2	Lecturing, field visit, group discussion, presentation, assignment, disease case study video	Quiz, short questions, MCQ, presentation, assignment, active class participation, sudden class test, question-answering, viva voce and final exam
CLO3	Lecturing, field visit, group discussion, presentation, assignment, disease case study-based study, prescription	Quiz, short questions, MCQ, presentation, assignment, viva voce and final exam
CLO4	Lecturing, field visit, institutional visit, group discussion, presentation, assignment, disease case study, prescription	Quiz, short questions, MCQ, presentation, assignment, viva voce and final exam

Learning Materials

Recommended Readings	Agrios, G.N. 2012. Plant Pathology. 5th ed., Academic press, New York. Ashrafuzzaman, M.H. 1976. A Lecture Guide to Crop Diseases. Department of Plant Pathology. BAU. Asrafuzzaman, M.H. 1991. A Text Book of Plant Pathology. Bangladesh Agricultural Res. Council, Dhaka. Boss, L. 1983. Introduction to plant virolology. Centre for Agricultural Publishing and Documentation, Wagenigen, Netherlands.
Supplementary Readings	Singh, R.S. 2017. Introduction to Principles of Plant Pathology. 4th ed., CBS Publishers & Distributors, India. Vashista, B.R. 2010. Botany for degree students' Fungi. S. Chand and company, New Delhi. Verma, H.K. 2012. A text book of Fungi. Random Publications. New Delhi. Dasgupta, K.M. 1998. Phytonematology. Nayaprokash, Calcutta. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw Hill Publishing Co., India. Mian, I.H. 1996. Introduction to Nematology. 2nd ed., Royea Begum, Gazipur, Bangladesh. Nene Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd ed., Oxford and IBH publishing co. pvt. Ltd. New Delhi. Rangaswami, G. 1972. Disease of Crop Plants in India. Prentice Hall of India Private Ltd. New Delhi. Rangswami, G. 1962. Bacterial Plant Diseases in India. Asia Publishing house, Bombay. Singh, R.S. 1994. Plant Diseases. 6th ed., Oxford and IBH Publishing Co. New Delhi. Singh, R.S. 1990. Plant Disease, 7th ed., Oxford and IBH publishing co. pvt. Ltd. New Delhi. Wheeler, B.E.J. 1969. An Introduction to Plant Diseases, John Wiley and Sons Ltd.

Course Code: 0811 08 AT 3202	Year: Third	Term: Second
Course Title	Principles of Plant Pathology and Diseases of Field Crops Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	This course is oriented to provide knowledge about identification, preservation and detail study of important field crop diseases.	

	Course Contents/Tasks	CLOs
1	Collection and preservation of diseased plant-materials herbarium sheets.	1
2	Field and laboratory studies of plant disease: A. For detailed study (study of symptoms, preparation of slides and identification of the pathogens). (i) Brown spot, blast and BLB of rice (ii) Stem rot, black band and anthracnose of Jute (iii) Stem rust, leaf rust and loose smut of wheat and covered smut of barley (iv) Tikka diseqses of groundnut (v) Root-knot diseases (vi) Cercospora leaf spot of mushkalai and mungbean (vii) Grey spot of mustard.	2, 3
	B. For brief study (Study of symptoms aided by permanent slides of the pathogen, if available). i) BLB, stem rot, bakanae, false smut, NBS, sheath blight, sheath rot, leaf scald, ufra, BLS of rice. ii) Leaf spot, soft rot and mosaic of jute iii) Angular leaf spot and ball rot of cotton iv) Foot and root rot, mosaic, rust, wilts and blights of pulse and oilseed crops v) Smut, wilt and red rot of sugarcane.	2
3	Field excursion for plant disease study.	3
4	Each student is required to submit a comprehensive report on the prepared herbarium, field excursion.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Collect and preserve diseased plant-materials properly.	1, 2
	CLO2	Identify diseases by observing symptoms in the laboratory and field.	1, 5, 9
	CLO3	Recognize causal organisms of the diseases.	1, 2, 5, 9
	CLO4	Generate report on field visit related to plant diseases.	1, 7, 8, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, lab handling demonstration, presentation, group discussion	Quiz, assignment, active class participation, sudden lab test, viva voce and final exam
CLO2	Lecturing, demonstration, presentation, group discussion, specific disease case studyin field and lab	Quiz, MCQ, presentation, assignment, active class participation, question answering, viva voce and final exam
CLO3	Lecturing, demonstration, presentation, group discussion, specific disease case study and farmers field visit	Assignment, quiz, question answering, presentation
CLO4	Presentation, group discussion, specific disease case study	Assignment, question answering, presentation

Learning Materials

Recommended Readings	Agrios, G.N. 2012. Plant Pathology. 5th ed., Academic press, New York. Ashrafuzzaman, M.H. 1976. A Lecture Guide to Crop Diseases. Department of Plant Pathology. Asrafuzzaman, M.H. 1976. Laboratory Manual of Plant Pathology. Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh
Supplementary Readings	Singh, R.S. 2017. Introduction to Principles of Plant Pathology. 4th ed., CBS Publishers & Distributors, India. Vashista, B.R. 2010. Botany for degree students' Fungi. S. Chand and company, New Delhi. Verma, H.K. 2012. A text book of Fungi. Random Publications. New Delhi. Barnett, H.L. and Hunter, B.B. 1972. Illustrated genera of imperfect Fungi. 3rd ed., Burgess publishing company, USA. Dhingra, O.D. and Sinclair, J.B. 1995. Basic Plant pathology methods. 2nd ed., Lewis publishers is an imprint of CRC press. Mian, I.H. 1995. Methods in Plant Pathology. IPSA-JICA Project Publication. Institute of Postgraduate Studies in Agriculture, Gazipur, Bangladesh.

Course Code: 0811 08 AT 3203		Year: Third	Term: Second
Course Title	Crop Ecology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course intends to describe different ecological factors and issues for successful crop production		

Course Contents		CLOs
	Section A	
1	Introduction to ecological factors for crop production: Concept of ecology and crop ecology; ecological factors- light, temperature, moisture and wind their distribution, effects and manipulation for improvement of crop production.	1
2	Atmospheric factors: Gaseous constituents of the atmosphere, climate change and global warming with ecological interventions and crop production.	1, 2
3	Edaphic factors: Classification, composition and effects on crop production, biogeochemical cycle and significance.	1
4	Biotic factors: Classification, effects and interrelationship on vegetation and crop production.	1
5	Biodiversity and crop production: Concept, classification, significance, methods of conservation, status of diversity of major cereals, pulses, vegetables and fruits.	2
	Section B	CLOs
6	Agro-ecosystem and productivity: Concept, component and functioning of different ecosystem, flow of energy and productivity in agro-ecosystem.	3
7	Crop association: Concept, types, Principles, practices and importance.	3
8	Environmental pollution and agrochemicals: Concept, sources and impact of water, air and soil pollution on agroecosystem with its remedial measures, adverse effect of agrochemicals on ecosystem; bioremediation.	4
9	Vegetation of Bangladesh: Composition, distribution, and significance of mangrove and coastal vegetation.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Characterize and narrate the role of ecological, atmospheric, edaphic and biotic factors for crop production and measure the productivity of agro-ecosystem.	1, 2, 7
	CLO2	Assume the impact of climate change on crop growth and explain the biodiversity of different crops with conservation strategy.	1
	CLO3	Characterize different types of environmental pollution with remedial measures on agro-ecosystem.	1, 3, 11
	CLO4	Simplify the significance of mangrove and coastal vegetation of Bangladesh.	1

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Quiz, objectives, active class participation, assignment) and summative (Term final)
CLO2	Lecture, video	Continuous (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO3	Lecture, group discussion, video	Continuous (Formative: Viva, presentation, active class participation) and summative (Term final)
CLO4	Lecture and field visit	Continuous (Formative: Active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Sukla, R.S. and Chandel, P.S. 1985. Plant Ecology. S Chand & Co. Ltd. New Delhi, India. Misra, K.C. 1980. Manual of Plant Ecology. 2nd ed., Narosa Publishing House, New Delhi, India. Mehra, V. B. and Khanna, S. K. 1982. Plant Ecology. S. Chand & Co. Ltd., India. Tansley. A. G. 1993. An introduction to Plant Ecology, Discovery Publishing House, New Delhi, India. Sharma, P. D. 2013. Ecology and Environment. 11th ed., Rastogi Publication, India.
Supplementary Readings	Santra, S. C. 1994. Ecology-Basic & Applied. MD publication pvt. Ltd. New Delhi, India. Sen, D.N. and Bansal, R.P. 1978. Environmental physiology and Ecology of Plants. M/s Bishen Singh Mahendra Pal Singh, India. Kimmins, J. T. 1987. Forest Ecology, McMillan Publishing Co. Ltd., USA. Loomis, R. S. and Cannor, D.J. 1992. Crop Ecology. Cambridge University Press. UK.

Course Code: 0811 08 AT 3204	Year: Third	Term: Second
Course Title	Crop Ecology Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	The course intends to describe different ecological factors and issues for successful crop production	

	Course Contents/Tasks	CLOs
1	Assessment of productivity in cultivated and natural ecosystems.	1
2	Experiment on adaptation of hydrophyte, xerophyte, mesophyte and halophyte.	1, 2
3	Biotic association of crop production.	1
4	Amendment practices for problem soil (water and salt)	1
5	Field trips.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Demonstrate the mechanism of adaptation and determine the productivity of hydrophytes, mesophytes and xerophytic crop plant with biotic association.	1, 2, 5
	CLO2	Soil amendment practices of problematic soil.	1, 5
	CLO3	Compare the composition of terrestrial, coastal and mangrove vegetation.	1, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, field visit	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)
CLO2	Lecture, demonstration, field visit	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)
CLO3	Lecture, demonstration, field visit	Continuous (Formative: Viva, presentation, active class participation, assignment) and summative (Term final)

Learning Materials

Recommended Readings	Sukla, R.S. and Chandel, P.S. 1985. Plant Ecology. S Chand & Co. Ltd. New Delhi, India. Misra, K.C. 1980. Manual of Plant Ecology. 2nd ed., Narosa Publishing House, New Delhi, India. Mehra, V. B. and Khanna, S. K. 1982. Plant Ecology. S. Chand & Co. Ltd., India. Tansley. A. G. 1993. An introduction to Plant Ecology, Discovery Publishing House, New Delhi, India. Sharma, P. D. 2013. Ecology and Environment. 11th ed., Rastogi Publication, India.
Supplementary Readings	Santra, S. C. 1994. Ecology-Basic & Applied. MD publication pvt. Ltd. New Delhi, India. Sen, D.N. and Bansal, R.P. 1978. Environmental physiology and Ecology of Plants. M/s Bishen Singh Mahendra Pal Singh, India. Kimmins, J. T. 1987. Forest Ecology, McMillan Publishing Co. Ltd., USA. Loomis, R. S. and Cannor, D.J. 1992. Crop Ecology. Cambridge University Press. UK.

Course Code: 0811 08 AT 3205		Year: Third	Term: Second
Course Title	Fundamentals of Extension, Communication and Leadership		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The graduates are intended to provide services to the farming community and for that reason, they need knowledge on extension approaches, communication strategies and leadership.		

	Course Contents	CLOs
	Section A	
1	Introduction: Concept, objectives and functions of agricultural extension; principles, phases, philosophy, scope of agricultural extension; interrelationship of agricultural extension, research and education; history and development of agricultural extension in Bangladesh; extension work in developed countries (especially USA and Japan) and SAARC countries. Digital approaches in providing extension services.	1, 2
2	Teaching methods in extension: Meaning, steps and guidelines of extension teaching; classification, procedures, advantages and disadvantages of different extension teaching methods, selection and combination of extension teaching methods. Extension teaching methods are suitable for the adverse pandemic situation.	3
3	Motivation and learning: Concept of motivation, learning, Maslow's need theory; theories and laws of learning and their implication; criteria for effective learning; special features of adult learning. Online-based teaching-learning techniques.	4
4	Learning assessment: Bloom's taxonomy of learning assessment, different assessment tools and techniques and their use.	4
	Section B	CLOs
5	Extension communication: Concept, importance and functions of communication; models of communication, elements in the communication process; feedback critical factors in extension communication; barriers to communication and its possible solution. Orientation of ICT in Agriculture.	5, 6, 7
6	Leadership in extension: Meaning and importance of leadership in extension work; kinds of leadership, the role of leaders, qualifications of a good leader; opinion leadership, characteristics of opinion leaders; selection, training and recognition of leaders. Leader's influence, authority, power (types and jurisdiction).	8, 9, 10
7	Population education: Concept and importance of population education need for education for agricultural and socio-economic development; participation of the population in agricultural extension programs.	11
8	Comparative extension education systems: Analysis of national extension education systems prevailing in selected countries with emphasis on comparative merits and elements having a universal application for strengthening the extension system in Bangladesh.	12

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Define and describe objectives, functions, principles, philosophies and phases of agricultural extension.	1
	CLO2	Compare extension work and approaches in DCs and SAARC countries.	2
	CLO3	Define, classify and select extension teaching methods.	1
	CLO4	Describe the need, motivation, need theory and laws of learning, learning assessment.	1
	CLO5	Define communication and its functions, importance, feedback, fidelity, and importance of feedback in extension communication.	1
	CLO6	Identify models, elements, critical factors and barriers to communication and their possible solutions.	1, 2
	CLO7	Describe the role and importance of ICT in agricultural extension.	1
	CLO8	Interpret the meaning, importance, leadership types, and role of leadership in extension.	11
	CLO9	Describe the qualifications of a good leader and characteristics of an opinion leader.	11
	CLO10	Select training and recognition procedure of leaders.	1, 11
	CLO11	Define the population, population education and its importance and needs for socio-economic and agricultural development.	9
	CLO12	Discuss ways of participation of the population in extension programs and comparative extension educational systems.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecture and team teaching	Quiz and class test
CLO5	Problem-based learning and presentation	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation
CLO8	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation
CLO9	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation
CLO10	Lecture and team teaching	Quiz and class test
CLO11	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam
CLO12	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam

Learning Materials

Recommended Readings	Alim, A. 1974. An Introduction to Bangladesh Agriculture. Swedish printing press, Dhaka. Bhuyian, M.A. 1988. Krishi Samprasaron Parichiti. Jamuna printers, Dhaka. Dahama, O.P. 1976. Extension and Rural Welfare. Ramprashad and sons, Agra, India. Kashem, M.A. 2006. Fundamentals of Agricultural Extension. Nilufar Kashem, Mymensingh.
Supplementary Readings	Van den Ban, A. W. and Hawkins, H. S. 2002. Agricultural Extension. CBS Publishers & Distributors. Karthikeyan, C., Sendikumar, R. and Jaganathan, D. 2009. A Textbook of Agricultural Extension Management. New India Publishing Agency, New Delhi, India. Food and Agriculture Organization of the United Nations. 2019. Agricultural Extension Manual for Extension Workers. http://www.dae.gov.bd Kashem, M. A. 1992. Samprasaron Biggan (Extension Science). The Bangladesh Packing Press, Dhaka. Kelsey, I. D. and Hearne, C. C. 1963. Co-operative extension work. Comstock Publishing Associates. Mergan, B., Holmes, G. E. and Bundy, C.L. 2012. Methods in Adult Education. Literary Licensing, LLC, USA. Ray, G. L. 2006. Extension Communication and Management. Joy Prakashani. Relevant other books/study materials would be provided by the Course Instructor.

Course Code: 0811 08 AT 3206	Year: Third	Term: Second
Course Title	Fundamentals of Extension, Communication and Leadership Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	The graduates are intended to provide practical knowledge on some basic facts and terms related to agriculture and to orient about the deliberation and development techniques of lecture and leadership.	

	Course Contents/Tasks	CLOs
1	Basic facts about Bangladesh agriculture.	1
2	Introduction to different organizations related to agricultural development and their activities.	2
3	Preparation and delivery of the lecture.	3
4	Preparation of poster, leaflet, pamphlet, etc.	4
5	Video content preparation for virtual channels.	4
6	Development of leadership through different group techniques-general meetings, small group discussion, Philip's 66 technique, brainstorming, role-playing and demonstrations.	5
7	Introduction to monitoring and evaluation tools used by DAE.	5
8	Field visit to different CIGs of DAE and NGOs .	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe the agriculture of Bangladesh defining some basic terms related to agricultural extension.	1
	CLO2	Differentiate different organizations related to agricultural sector of Bangladesh and describe their activities.	7
	CLO3	Design and perform a typical lecture.	9
	CLO4	Prepare poster, leaflets, pamphlet, digital content, etc.	9
	CLO5	Demonstrate general meetings, small group discussion, Philip's 66 technique, role-playing and conduct brainstorming for developing leadership, CIG, monitoring and evaluation.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam
CLO5	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam

Learning Materials

Recommended Readings	Alim, A. 1974. An Introduction to Bangladesh Agriculture. Swedish printing press, Dhaka. Bhuyian, M.A. 1988. Krishi Samprasaron Parichiti. Jamuna printers, Dhaka. Dahama, O.P. 1976. Extension and Rural Welfare. Ramprashad and sons, Agra, India. Kashem, M.A. 2006. Fundamentals of Agricultural Extension. Nilufar Kashem, Mymensingh.
Supplementary Readings	Van den Ban, A. W. and Hawkins, H. S. 2002. Agricultural Extension. CBS Publishers & Distributors. Karthikeyan, C., Sendikumar, R. and Jaganathan, D. 2009. A Textbook of Agricultural Extension Management. New India Publishing Agency, New Delhi, India. Food and Agriculture Organization of the United Nations. 2019. Agricultural Extension Manual for Extension Workers. http://www.dae.gov.bd Kashem, M. A. 1992. Samprasaron Biggan (Extension Science). The Bangladesh Packing Press, Dhaka. Kelsey, I. D. and Hearne, C. C. 1963. Co-operative extension work. Comstock Publishing Associates. Mergan, B., Holmes, G. E. and Bundy, C.L. 2012. Methods in Adult Education. Literary Licensing, LLC, USA. Ray, G. L. 2006. Extension Communication and Management. Joy Prakashani. Relevant other books/study materials would be provided by the Course Instructor.

Course Code: 0811 08 AT 3207		Year: Third	Term: Second
Course Title	Olericulture		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	Students will be taught different aspects of vegetable crops to convey knowledge on its cultivation practices.		
Objective	To convey the students with knowledge on vegetable crops in respect of production and management practices.		

	Course Contents	CLOs
	Section A	
1	Introduction to vegetables: Background, status of production and export, importance, scope and associated problems of vegetables production in Bangladesh.	1
2	Common vegetables of Bangladesh: Classification, nomenclature, morphology and growth habit of different vegetable crops of Bangladesh.	2
3	Ecological factors affecting vegetable production: Role of temperature, light, air, water and soil on the growth and development of vegetable crops.	2
4	Production of vegetables: Soil, climate, varieties, land preparation, fertilizer application, sowing time, sowing techniques, seed rate, water management, control of weed, insect and diseases, harvest and post harvest operations of tomato, brinjal, cole crops, radish, lady's finger, cucurbits, potato, sweet potato, aroids, spinach, Indian spinach and garden pea.	3
5	Production of some non-traditional vegetables: Scope, climatic requirements and production practices of mushroom, drumstick, dioscorea, asparagus, bunching onion, lettuce, squash and indigenous vegetables.	3
	Section B	CLOs
6	Vegetable production under special system: Protective cropping systems, floating bed vegetable production, homestead vegetable gardening, different models of vegetable gardening and hydroponics.	3
7	Nutrition of vegetable crops: Deficiency and nutrient requirement of root, fruit and leafy vegetables, organic farming, nutrient film technique in vegetable production.	4
8	Growth regulators in vegetable production: Use of growth regulators in propagation, vegetative growth, flowering, fruiting, seed production and post harvest management of vegetable crops.	5
9	Vegetable crop improvement: Introduction, selection, hybridization, use of male sterility, heterosis, polyploidy, incompatibility, recombinant DNA technology and protoplast fusion in vegetable improvement.	5
10	Seed production of vegetables and storage: Present status and constraints; production and storage of quality seeds of different vegetables, factors affecting production of quality seeds and in storage condition, methods of storage of vegetables seed.	3

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Define and classify vegetables as well as assess the present scenario of its cultivation.	1, 2, 3
	CLO2	Narrate the morphology and ecology of vegetable crops	2, 3
	CLO3	Depict the production technology (traditional practices and under special system) of major and non-traditional vegetables along with their seeds production.	2, 5
	CLO4	Identify the nutritional requirements and deficiency symptoms of vegetable crops.	2, 3
	CLO5	Explain the improvement perspectives and use of growth regulators in vegetable production.	5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, demonstration, group discussion	Formative (Quiz, objectives, active class participation), summative
CLO2	Lecturing, demonstration field visit, group discussion	Formative (Quiz, assignment, objectives, active class participation), summative
CLO3	Lecturing, demonstration field visit, group discussion, report writing/ assignment	Formative (Objectives, quiz, question-answering, presentation), summative
CLO4	Lecturing, video, demonstration field visit, group discussion, report writing	Formative (Viva, quiz, short questions, MCQ, presentation), summative
CLO5	Lecturing, demonstration group discussion, assignment	Formative (Viva, quiz, short questions, MCQ, question-answering, presentation), summative

Learning Materials

Recommended Readings	Bhat, K.L. 2009. Physiological Disorder of Vegetable Crops. Daya Publishing House, India. Bose, T.K. and Som, M.G. 2003. Vegetable Crops in India. Naya Prokash. Calcutta, India. Hussain, G.J. 2012.Tropical Vegetable Production. SBS Pub. India. Katyal, S.L. and Chadha, K.L. 1995. Vegetable growing in India. Oxford and IBH publishing Co. Ltd. New Delhi, India.
Supplementary Readings	Nonnecke, I.L. 1989. Vegetable production. Van Nostrand Reinhold. Melbourne, Victoria, Australia. Robinson, R.W. 2004. Cucurbits: Crop Production Science in Horticulture. CABI, UK. Thompson, H.C. and Kellay, W.C. 1957. Vegetable crops. McGraw-Hill Boob Company, London. Tindal. H.D. 1983. Vegetables in the Tropics. Macmillan Education Ltd. London. Department of Agricultural Extension (DAE) 1995. Training manual Summer and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE. Department of Agricultural Extension (DAE) 1995. Training manual Winter and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE. Online Resources

Course Code: 0811 08 AT 3208		Year: Third	Term: Second
Course Title	Olericulture Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	Students will be taught on various aspects of cultivation and management of vegetables along with BCR analyses to grow skills on management practices.		
Objective	To enable the students in overall management of vegetable cultivation.		

	Course Contents/Tasks	CLOs
1	Identification of seeds and seedlings of vegetables.	1
2	Estimation of seed rate and fertilizer dose for different vegetable crops.	2
3	Methods of planting vegetables: sowing, dibbling and transplanting.	3
4	Study of the important morphological features related to production of some important vegetables.	1
5	Seed extraction and processing technique in brinjal, tomato, cabbage and white gourd.	3
6	Cultivation of vegetables in plot and report writing.	3
7	Album preparation on different seeds and seedlings of vegetables.	4
8	Estimation of cost of cultivation of important vegetables.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify the seeds and seedlings of vegetables along with morphological features and cultivation practices.	1, 2
	CLO2	Estimate the seed rate, fertilizer dose and cost of cultivation for vegetables.	3, 5, 9
	CLO3	Demonstrate planting methods, cultivation practices along with seed extraction and processing of vegetables.	2, 3, 9
	CLO4	Prepare seed and seedling album.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, demonstration, discussion	Formative (Quiz, active class participation), summative
CLO2	Calculation, discussion	Formative (Quiz, calculation), summative
CLO3	Lecturing, demonstration	Formative (question-answering, quiz), summative
CLO4	Demonstration, presentation	Formative (viva, quiz), summative

Learning Materials

Recommended Readings	Bose, T.K. and Som, M.G. 2003. Vegetable Crops in India. Naya Prokash. Calcutta, India. Hussain, G.J. 2012.Tropical Vegetable Production. SBS Pub. India. Katyal, S.L. and Chadha, K.L. 1995. Vegetable growing in India. Oxford and IBH publishing Co. Ltd. New Delhi, India. Nonnecke, I.L. 1989. Vegetable production. Van Nostrand Reinhold. Melbourne, Victoria, Australia. Pruthin, J.S. 1986. Spices and condiments. National Book Trust, New Delhi, India.
Supplementary Readings	Purseglove, J.W., Brown, E.G., Green, C.L. and Robbing, S.J. 1981. Spices, Vol. I & II Longman Group, UK. Ltd. London. Robinson, R.W. 2004. Cucurbits: Crop Production Science in Horticulture. CABI, UK. Thompson, H.C. and Kellay, W.C. 1957. Vegetable crops. McGraw-Hill Boob Company, London. Tindal. H.D. 1983. Vegetables in the Tropics. Macmillan Education Ltd. London. Department of Agricultural Extension (DAE) 1995. Training manual Summer and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE. Department of Agricultural Extension (DAE) 1995. Training manual Winter and all-season vegetable and spice production. Horticulture Research and Development project in collaboration with DAE. Online Resources

Course Code: 0811 08 AT 3211		Year: Third	Term: Second
Course Title	Horticulture and Forest Nursery Management		
Course Status	Optional		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course is arranged to deliver knowledge on horticulture and forest nursery management to familiarize the students with the topic.		
Objective	To develop the capability of the students on establishment, production improvement and management of horticultural and forest nursery.		

	Course Contents	CLOs
	Section A	
1	Establishment of nursery for horticultural plants: Selection of site and layout for different sections of horticultural plants.	1, 2
2	Improvement approaches for horticultural crops in nursery: Superior cultivar identification, selection and collection; establishment and care of mother tree blocks, restoration of old mother trees and orchards.	3, 4
3	Production of seedlings in horticulture nursery: Collection and storage of good seeds and propagation materials in horticulture nursery, multiplication of seedlings, packaging of different plant structures, preparation of seedlings for transportation.	3
	Section B	CLOs
4	Nursery for raising seedlings of forest plants: Different types of forest nurseries, site selection, development and layout of forest nursery; nursery equipment; raising seedlings on the nursery bed and in containers.	1, 3
5	Maintenance of the nursery: Types of protecting structures in a nursery and protection measures in them; soil, water and nutrient management in nursery; handling, sorting and grading of seedlings, hardening of the seedlings.	3
6	Nursery practices for some selected forest plants: Nursery practices for teak, gamar, kanthel, eucalyptus, jackfruit etc.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Discuss the types of nurseries with site selection criteria.	1, 2, 5
	CLO2	Design horticultural and forest nurseries.	3, 9
	CLO3	Collect, storage, multiplication and packaging of planting materials for nurseries.	2, 3, 5, 9
	CLO4	Judging mother trees for nurseries.	1, 5, 8, 9
	CLO5	Assess nursery practice.	2, 3, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Demonstration and Group Discussion	Formative (Quiz, objectives, active class participation) and summative
CLO2	Lecture, Demonstration and Group Discussion	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstrationfield visit, group discussion	Formative (Objectives, quiz, question-answering, presentation) and summative
CLO4	Lecturing, Group discussion, demonstration, presentation, field visit, report writing	Formative (Objectives, quiz, short questions, MCQ, presentation) and summative
CLO5	Lecturing, video demonstration, presentation, assignment, field visit, assignment	Formative (Viva, quiz, short questions, MCQ, presentation) and summative

Learning Materials

Recommended Readings	Augusti, E. and Baglini, M. 1990. Ornamental nursery farm management. Ed. Agricole, Bologna. Forest department handbook on tree nursery and plantation establishment. Ministry of Environment and Forests, ASDB/UNDP/FAO, Dhaka.
Supplementary Readings	Gill, S.S., Bd, J.S. and Sandhu, A.S. 1991. Raising fruit nursery. Kalyani publishers. New Delhi. Mc. Gregor, B.M. 1987. Tropical products transport handbook. U.S. Department of Agriculture. Agriculture Handbook No. 668. Puri, S. and Khosla, P.K. 1993. Nursery technology for agroforestry application in arid and semiarid regions. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

Course Code: 0811 08 AT 3212		Year: Third	Term: Second
Course Title	Horticulture and Forest Nursery ManagementSessional and Fieldwork		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course covers various aspects of planning, layout, establishment and management of nursery to include required knowledge of best nursery practices.		
Objective	To introduce the students with practices and management of nursery so that they can apply their knowledge in this field.		

	Course Contents/Tasks	CLOs
1	Planning and layout of an ideal forest and horticulture nursery.	1
2	Nursery management and practices.	2
3	Seed selection, preservation and germination in nursery.	2
4	Steps in making seed bed and transplanting seedlings.	2, 3
5	Multiplication of seedlings in nursery.	3
6	Types, features and uses of containers and pots.	4
7	Preparation of nursery mixture and compost.	4
8	Establishment and care of mother tree block.	2
9	Packing of potted plants and cut flowers for transportation.	4
10	Visiting established nursery.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Layout an ideal horticultural and forest nursery.	1, 2, 3, 9
	CLO2	Practice nursery management.	2, 3, 9
	CLO3	Replicate planting materials.	2, 3, 9
	CLO4	Develop skills on pot culture.	1, 2, 9
	CLO5	Gain practical knowledge through visiting established nursery.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, video demonstration and group discussion	Formative (Quiz, performance evaluation, active class participation) and summative
CLO2	Lecture, video demonstration and discussion	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstration and discussion	Formative (Objectives, quiz, question-answering, presentation) and summative
CLO4	Lecture, video demonstration and discussion	Formative (Objectives, quiz, question-answering, presentation) and summative
CLO5	Field visit, report writing	Formative (Objectives, quiz, question-answering, presentation) and summative

Learning Materials

Recommended Readings	Augusti, E. and Baglini, M. 1990. Ornamental nursery farm management. Ed. Agricole, Bologna. Forest department handbook on tree nursery and plantation establishment. Ministry of Environment and Forests, ASDB/UNDP/FAO, Dhaka.
Supplementary Readings	Gill, S.S., Bd, J.S. and Sandhu, A.S. 1991. Raising fruit nursery. Kalyani publishers. New Delhi. Mc. Gregor, B.M. 1987. Tropical products transport handbook. U.S. Department of Agriculture. Agriculture Handbook No. 668. Puri, S. and Khosla, P.K. 1993. Nursery technology for agroforestry application in arid and semiarid regions. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

Course Code: 0521 08 AT 3213		Year: Third	Term: Second
Course Title	Environmental Pollution and Crop Growth		
Course Status	Optional		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is designed to provide knowledge on environmental pollution and its impacts on crop production		

	Course Contents	CLOs
	Section A	
1	Introduction to environmental pollution.	1
2	Source of environmental pollution, types and characteristics of domestic, industrial and agricultural wastes-their effects on water bodies, industrial gases and refuges.	1
3	Agricultural chemicals-classification and sources of toxic substances and its pathways into ecosystem, bioaccumulation, biomagnification, biomonitoring; radioactive materials and crop growth.	1
4	Loss concerning environmental pollution, protocol, ethics, conventions and treaties.	2
	Section B	CLOs
5	Phyto-sociology of crops-history of agricultural production, pollution in relation to agricultural development.	3
6	Mechanisms to crop injury by various types of pollutants.	3
7	Corrective measures to crop plant injury through pollutants.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Narrate the impact of agrochemicals and pollution on crop growth.	1, 2
	CLO2	Enumerate environmental protocol and ethics concerning pollution.	1, 4
	CLO3	Explain different management practices to minimize environment pollution.	1, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, demonstration	Continuous (Formative: Objectives, active class, participation, assignment) and summative (Term final)
CLO2	Lecture, video	Continuous (Formative: Quiz, active class participation) and summative (Term final)
CLO3	Lecture, group discussion, video	Continuous (Formative: Presentation, assignment) and summative (Term final)

Learning Materials

Recommended Readings	Das, P.C.1995. Principles and Practices of Crop Production. South Asia Pub. Delhi. Mavi, H.S. 1994. Introduction to Agrometeorology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi. Menteith, J.L. 1980. Principles of Environmental Physics. Whitstable Litho Ltd. Whitstable, Kent, UK. Neiburger, M., Edinger, J.G. and William, D.B. 1973. Understanding. Our Atmospheric Environment. W.H. Freeman and Company, San Francisco.
Supplementary Readings	Petterssen, S. 1969. Introduction to Meteorology, 3rd ed. McGraw-Hill Book Company, New York. Pierre, W.H., Don, K., John, P. and Robert, S. 1981. Plant Environment and Efficient Water Use. American Society of Agronomy and Soil Science. Wisconsin, USA. Rosenberg, N.J. 1974. Microclimate: The Biological Environment. John Wiley & Sons, New York. Environmental Pollution and Research Journal Science of the Total Environment Journal

Course Code: 0731 08 URP 3254		Year: Third	Term: Second
Course Title	GIS Sessional-II		
Course Status	Optional		
Credit	1.5		
Prerequisite(s)	None		
Rationale	This course is designed to provide knowledge on techniques, data conversation, processing, analysis, preparation of GIS and remote sensing based spatial analysis in agriculture.		

	Course Contents/Tasks	CLOs
1	GIS and Remote Sensing: Data management techniques in GIS, map Algebra using raster GIS, data conversion in GIS.	1
2	Basic of remote sensing, major satellites for earth resources observation, optics of remote sensing, energy and its different bands in remote sensing.	2
3	Delineation of cropland using Landsat, spot and IRS digital image, classification of agriculture land using visible and NIR bands, crop inventory and crop production.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Understand and practice data analysis techniques in GIS.	1, 3, 11
	CLO2	Understand basic remote sensing system and image analysis in agricultural application use.	1, 2, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration	Continuous (Formative: Viva, active class participation) and summative (Term final)
CLO2	Lecture, demonstration	Continuous (Formative: Viva, active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Bonham-carter, G.F. 1994. Geographical Information System for Geoscientists- Modeling with GIS Pergamon. Burrough, P.A. 1986. Principles of Geographical Information System for Land Resources Assessment. Clarendon.
Supplementary Readings	DeMers, M.N., 2000. Fundamentals of Geographic Information Systems. 2nd ed., John Wiley & Sons, Inc., New York.

Course Code: 0588 08 RM 3255		Year: Third	Term: Second
Course Title	Research Methodology		
Course Status	Core		
Credit	2.0		
Prerequisite(s)	None		
Rationale	This course covers various aspects of research and research process. Studying the course, students can carry out research in future under the supervision of a teacher.		

	Course Contents	CLOs
	Section A	
1	Introduction: Definition and importance of research; research process; characteristics of a good research project; defining and selecting a researchable problem.	1
2	Tools for data collection: Definition, Preparation of questionnaire, Collection of Primary and Secondary data, methods of interview, designing social experiment.	2
3	Introduction to Sampling: Sampling Distribution and Standard Error, Sample Surveys in Agriculture, Simple Random Sampling, Stratified Random Sampling, Systematic Sampling, Cluster and Multi-Stage Sampling, Purposive Sampling.	2
4	Preparing a research proposal and writing a thesis/report: Discussion on different sections of research proposal and thesis/repots, their construction.	3
	Section B	CLOs
5	Definition, need for designing an experiment – Basic principles of Experimentation. Practical considerations in field experimentation. Soil heterogeneity, Uniformity trials, Size and Shape of Plots and Blocks, Border effects.	4, 5
6	Methods of analysis of data from designed experiments. Analysis of Variance, assumptions, Construction of ANOVA Table. Completely Randomized Design: Layout and Analysis, advantages and limitations. Randomized Block Design: Layout and Analysis, advantages and limitations. Latin Square Design: Layout and Analysis, advantages and limitations. Factorial experiments, Main effects and Interaction effects. Advantages of Factorial Experiments over Single Factor Experiments. Analysis of data from Factorial experiments. Split plot Design – Layout and Analysis. Strip-plot Design – Layout and Analysis. Mean separation.	4, 5
7	Problem data or data that violate the assumptions of Analysis of Variance: Transformation of data, square root, Logarithmic and Angular Transformations, Missing plot techniques in RBD and LSD.	4, 5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe research and research process.	1, 2, 10
	CLO2	Explain different ways of data collection.	1, 2
	CLO3	Prepare research proposal/thesis/report.	1, 2, 4, 5, 10
	CLO4	Formulate different design of experiment.	1, 2, 3, 4, 10
	CLO5	Analyze data from designed experiment.	1, 2, 3, 10, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, PPT, discussion	Continuous assessment (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO2	Lecturing, PPT, demonstration	Continuous assessment (Formative: Quiz, active class participation, objective, question-answering, problem solving) and summative (Term final)
CLO3	Lecturing, discussion, pair teaching, assignment	Continuous assessment (Formative: Objectives, quiz, question-answering, group discussion, presentation) and summative (Term final)
CLO4	Lecturing, group discussion, presentation,	Continuous assessment (Formative: Short questions, presentation) and summative (Term final)
CLO5	Lecturing, discussion, problem analysis	Continuous assessment (Formative: Short questions, problem solving) and summative (Term final)

Learning Materials

Recommended Readings	Balakrishnan, N. 2002. Statistical Methods and Practice. Prentice Hall of India. Chakravorthi, S.R. and Giri, N. 2002. Basic Statistics. South Asian Publishers, New Delhi. Cochran, W.G. 1989. Sampling Techniques. Oxford and IBH Publishing Co. Croxton, F.E. and Cowden, D.J. 1966. Applied General Statistics. Prentice Hall of India Pvt. Ltd., New Delhi.
Supplementary Readings	Zar, J.H. 2005. Biostatistical Analysis. 4th ed., Pearson Education, India. Fisher. R.A. 1950. Statistical Methods for Research Workers. 11th ed., Oliver & Boyd, Edinburg. Fisher, R.A. and Yates, F. 1948. Statistical Tables for Biological, Agricultural and Medical Research. Oliver & Boyd, Edinburg. Gupta, S.C. and Kapoor, V.K. 1997. Fundamentals of Mathematical Statistics. Sultan Chand & Sons Publisher, New Delhi. Panse, V.G. and Sukhatme, P.V. 1967. Statistical Methods for Agricultural Workers. ICAR, New Delhi. Rangaswamy, R. 2002. A text book of Agricultural Statistics. John Wiley & Sons. Snedecor, G.W. and Cochran, W.G. 1992. Statistical Methods. Oxford and IBH Publishing Co.

Course Code: 0588 08 RM 3256	Year: Third	Term: Second
Course Title	Research Methodology Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	This course is introduced to discuss applied features of research and research process.	

	Course Contents/Tasks	CLOs
1	Layout and analysis of data from CRD, RBD and LSD.	1
2	Transformation of data and analysis.	4
3	Missing plot techniques in RBD and LSD.	1
4	Analysis of Covariance.	1
5	Analysis of data from factorials experiments (CRD, RBD, Split plot and Strip plot Designs).	1
6	Preparation of questionnaire.	3
7	Preparation of research proposal and writing scientific paper.	5
8	Drawing Sample from different population.	3
9	Analysis of data using computer packages.	1, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Plan experiments and analyze data from different experimental design using computer packages.	1, 2, 3, 4, 10, 12
	CLO2	Prepare questionnaire and research proposal.	1, 2, 4, 5, 7, 10, 12
	CLO3	Draw sample from different population.	1, 2, 4, 10, 12
	CLO4	Transform and analyze abnormal data.	1, 2, 3, 4, 10, 12
	CLO5	Write thesis and scientific report.	1, 2, 4, 5, 7, 8, 10, 11, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, demonstration, group discussion, report writing	Sessional assessment (Formative: Quiz, objectives, active class participation and viva)
CLO2	Lecturing, problem exercise, method demonstration, assignment	Sessional assessment (Formative: Viva, quiz, short questions, MCQ, presentation and viva)
CLO3	Lecturing, problem exercise	Sessional assessment (Formative: Quiz, objectives, active class participation and viva)
CLO4	Lecturing, demonstration, problem analysis	Sessional assessment (Formative: Quiz, objectives, active class participation and viva)
CLO5	Lecturing, demonstration	Sessional assessment (Formative: Quiz, objectives, active class participation and viva)

Recommended Readings	Balakrishnan, N. 2002. Statistical Methods and Practice. Prentice Hall of India. Chakravorthi, S.R. and Giri, N. 2002. Basic Statistics. South Asian Publishers, New Delhi. Cochran, W.G. 1989. Sampling Techniques. Oxford and IBH Publishing Co. Croxton, F.E. and Cowden, D.J. 1966. Applied General Statistics. Prentice Hall of India Pvt. Ltd., New Delhi. Zar, J.H. 2005. Biostatistical Analysis. 4th ed., Pearson Education, India.
Supplementary Readings	Fisher. R.A. 1950. Statistical Methods for Research Workers. 11th ed., Oliver & Boyd, Edinburg. Fisher, R.A. and Yates, F. 1948. Statistical Tables for Biological, Agricultural and Medical Research. Oliver & Boyd, Edinburg. Gupta, S.C. and Kapoor, V.K. 1997. Fundamentals of Mathematical Statistics. Sultan Chand & Sons Publisher, New Delhi. Panse, V.G. and Sukhatme, P.V. 1967. Statistical Methods for Agricultural Workers. ICAR, New Delhi. Rangaswamy, R. 2002. A text book of Agricultural Statistics. John Wiley & Sons. Snedecor, G.W. and Cochran, W.G. 1992. Statistical Methods. Oxford and IBH Publishing Co.

Fourth Year First Term			
Course Code: 0811 08 AT 4101		Year: Fourth	Term: First
Course Title	Plant Breeding		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is designed to make students familiar with genetic and breeding principles with a view to improving crop plants suitable to different AEZ of Bangladesh.		

Course Contents		CLOs
Section A		
1	Introduction: Definition, objectives, scope; importance, goal and limitations of plant breeding, landmarks in plant breeding, activities in plant breeding, and the contribution of plant breeding in agriculture.	1
2	Plant genetic resources: Crop germplasm, types, importance, collection, systematic evaluation, and conservation; evolution of crop plants, centers of origin of crop plants; genetic resources centers; genetic erosion, quarantine regulation for exchanging plant genetic resources.	1
3	Reproductive systems in cultivated plants: Methods of reproduction- sexual, asexual, and vegetative; types of flower structure; mechanisms of self and cross-pollination, the genetic significance of pollination.	2
4	Plant breeding methods: Introduction, domestication, and acclimatization; hybridization- principles, objectives, and types; selection- natural and artificial, breeding methods for self-pollinated, cross-pollinated, and vegetatively propagated crops.	2
Section B		CLOs
5	Distant hybridization: Definition, application, and methods to overcome reproductive barriers.	3
6	Ploidy manipulation: Genetic segregation in polyploids; induction and use of auto- and allopolyploids, advantages and limitations of ploidy breeding.	3
7	Mutation breeding: Induction and utilization of mutants in crop improvement, advantages and limitations of mutation breeding.	3
8	Heterosis and its exploitation: The concept of heterosis, hybrid vigor, estimation of heterosis, inbreeding depression, male sterility, and self-incompatibility; principles of hybrid seed production; types and use of heterotic hybrids.	4
9	Stress breeding: Mechanisms of biotic and abiotic resistance in plants, breeding methods for diseases, insects, drought and salinity resistance, achievements.	4
10	Quantitative inheritance and plant breeding: Concept and characteristics of quantitative inheritance, population structure and gene frequency, the effect of genes in quantitative inheritance; calculating the number of multiple genes; transgressive variation; modifying factors; inbreeding; Hardy-Weinberg law; heritability and its role in genetic advance, the significance of quantitative genetics.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Evaluate the importance of genetic resources in crop improvement.	1, 2
	CLO2	Illustrate different reproductive organs of plants and describe modes of pollination and reproduction.	1, 2, 5
	CLO3	Select appropriate breeding methods to develop need-based new crop varieties.	2, 3
	CLO4	Explain stress breeding methods and assess components of population genetics and their utilization.	1, 2, 5, 9, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment, presentation
CLO2	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment, presentation
CLO3	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment, presentation
CLO4	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment, presentation

Learning Materials

Recommended Readings	Bahl, P.N. Salimath, P.M. and Mandal, A.K. 1996. Genetics, Cytogenetics and Breeding of Crop Plants, Volume 1, Pulses and Oil Seeds. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Bahl, P.N. Salimath, P.M. and Mandal, A.K. 1997. Genetics, Cytogenetics and Breeding of Crop Plants, Volume 2, Cereal and Commercial Crops. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Blum, A. 1988. Plant Breeding for Stress Environments, CRC Press, Inc., Boca Raton, Florida. Chopra, V.L. 2001. Breeding Field Crops, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi/ Calcutta. Chopra, V.L. 2005. Plant Breeding Theory and Practice, 2nd ed. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi.
Supplementary Readings	Chopra, V.L. and Paroda, R.S. (eds.) 1986. Approaches for Incorporating Drought and Salinity Resistance in Crop Plants. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Christiansen, M.N. and Lewis, C.F. (eds.) 1982. Breeding Plants for Less Favourable Environments. John Wiley and Sons, New York. Frankel, R. (ed.) 1983. Heterosis: Reappraisal of Theory and Practice. Monograph, Theor. Appl. Genet. Vol. 6. Springer, Berlin. Sing, B.D. 2003. Plant Breeding. Kalyani Publishers, New Delhi. Sing, B.D. 2005. Plant Breeding: Principles and Methods. 7th revised and enlarged ed. Kalyani Publishers, New Delhi. Sing, P. 2004. Essentials of Plant Breeding. Kalyani Publishers, New Delhi. Singh, M.P. and Dey, S. 2004. Bioresources and Genepool Conservation. Daya Publishing House, Delhi Sinha, U. and Sinha, S. 1998. Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House Pvt. Ltd. Delhi.

Course Code: 0811 08 AT 4102		Year: Fourth	Term: First
Course Title	Plant Breeding Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide practical knowledge of the principles and methods of plant breeding.		

	Course Contents/Tasks	CLOs
1	Hybridization techniques: Floral biology, pollination system, and crossing techniques in crop plants, such as rice, wheat, maize, pea, mustard, tomato, and brinjal.	1, 2
2	Demonstration of field experiments: a) Demonstration of parental, hybrid, and segregating populations and data collection. b) Demonstration of breeding research activities in a GPB experimental farm.	2, 3
3	Statistical analysis of plant breeding and genetic experiments: a) Data analysis for variety testing and other experiments, using a RCB design-ANOVA, test of significance and mean separation. b) Plant characters' association: correlation and regression analysis. c) Estimation of heterosis, heritability, and No. of genes controlling quantitative characters.	4
4	Visit research stations.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Evaluate the importance of genetic resources in crop improvement.	1, 2, 7, 10
	CLO2	Illustrate different reproductive organs of plants and describe modes of pollination and reproduction.	2
	CLO3	Select appropriate breeding methods to develop need-based new crop varieties.	3
	CLO4	Explain stress breeding methods and assess components of population genetics and their utilization.	1, 2, 5, 9, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO2	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO3	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO4	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce

Recommended Readings	Bahl, P.N. Salimath, P.M. and Mandal, A.K. 1996. Genetics, Cytogenetics and Breeding of Crop Plants, Volume 1, Pulses and Oil Seeds. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Bahl, P.N. Salimath, P.M. and Mandal, A.K. 1997. Genetics, Cytogenetics and Breeding of Crop Plants, Volume 2, Cereal and Commercial Crops. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Blum, A. 1988. Plant Breeding for Stress Environments, CRC Press, Inc., Boca Raton, Florida. Chopra, V.L. 2001. Breeding Field Crops, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi/ Calcutta. Chopra, V.L. 2005. Plant Breeding Theory and Practice, 2nd ed. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi.
Supplementary Readings	Chopra, V.L. and Paroda, R.S. (eds.) 1986. Approaches for Incorporating Drought and Salinity Resistance in Crop Plants. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Christiansen, M.N. and Lewis, C.F. (eds.) 1982. Breeding Plants for Less Favourable Environments. John Wiley and Sons, New York. Frankel, R. (ed.) 1983. Heterosis: Reappraisal of Theory and Practice. Monograph, Theor. Appl. Genet. Vol. 6. Springer, Berlin. Sing, B.D. 2003. Plant Breeding. Kalyani Publishers, New Delhi. Sing, B.D. 2005. Plant Breeding: Principles and Methods. 7th revised and enlarged ed. Kalyani Publishers, New Delhi. Sing, P. 2004. Essentials of Plant Breeding. Kalyani Publishers, New Delhi. Singh, M.P. and Dey, S. 2004. Bioresources and Genepool Conservation. Daya Publishing House, Delhi Sinha, U. and Sinha, S. 1998. Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House Pvt. Ltd. Delhi.

Course Code: 0811 08 AT 4103	Year: Fourth	Term: First
Course Title	Pomology	
Course Status	Core	
Credit	3.0	
Prerequisite(s)	None	
Rationale	The course is designed to deliver knowledge on production and management practices of fruit crops to familiarize the students with advanced technologies in this field.	
Objective	To develop students' skill in applying advanced technologies to boost up the production of fruit crops.	

	Course Contents	CLOs
	Section A	
1	General aspects of fruit production in Bangladesh: Definition, importance, present status, problems and scope of fruit production in Bangladesh, Classification of fruit; nomenclature of fruit plants; edible portions of fruit.	1
2	Ecological factors: Ecological factors affecting cultivation of fruit; major fruit growing regions of the world, their climatic features and distribution of fruit plants; regional distribution of the common fruits of Bangladesh.	2
3	Production of major fruits: Detailed study of the following fruits with emphasis on biology, importance, soil, climate, varieties, propagation, planting, manuring and fertilizing, irrigation and drainage, training and pruning, disease and insect control, harvesting, storage and marketing- mango, jackfruit, banana, pineapple, papaya, litchi, guava, coconut, melons, jujube and citrus.	3
4	Establishment and management of fruit orchards and homestead gardens: Concept, site selection, land development, planting plans and orchard management practices, unfruitfulness- causes and remedies, use of growth regulators in fruit industry.	5
	Section B	CLOs
5	Nutrition of fruit crops: Role of essential elements with special reference to fruit crops, deficiency symptoms and nutritional requirements of major fruit crops.	4
6	Physiology of flowering, fruit set and fruit development: Factors influencing flower bud initiation, differentiation, pollination, fertilization, fruit set, growth, development, parthenocarpy and seedlessness.	2
7	Production of exotic and minor fruits: Importance, morphology, ecophysiology, culture and management of the following fruits: Avocado, cashew nut, grapes, strawberry, dragon fruit, macademia nut, mangosteen, rambutan, apple and pear and minor fruits: lotkon, sapota, wood apple, pomegranate, palmyra palm, aonla, bilimbi, wax jambu, hog plum, star apple, jamun, grape fruit, bullocks' heart, custard apple, elephant apple, velvet apple and carambola.	3
8	Post-harvest handling, processing and preservation of fruits: Post harvest physiology, factors affecting post harvest quality and shelf life, causes of spoilage and remedies; objectives, principles and methods of preparation of value added products.	3

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Define and classify fruit as well as narrate the problems, scopes and importance of its cultivation.	1, 2, 3
	CLO2	Describe the ecological factors for fruit production along with physiology of flowering, fruit set and fruit development.	2
	CLO3	Discuss the production and management (pre- and post-harvest) of major, minor and exotic fruits.	2, 3, 5, 9
	CLO4	Explain the nutritional requirements and deficiency symptoms of fruit crops.	2, 3, 9
	CLO5	Summarize the perspectives of establishment and management of orchards and homestead gardens.	2, 3, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, demonstration	Formative (Quiz, objectives, active class participation), summative
CLO2	Lecturing, video, demonstration, field visit	Formative (Quiz/MCQ, assignment, objectives, active class participation), summative
CLO3	Lecturing, video, demonstration field visit, group discussion, report writing	Formative (Objectives, quiz, question-answering, presentation), summative
CLO4	Group discussion, demonstration, presentation, case study	Formative (Objectives, quiz, short questions, MCQ, presentation), summative
CLO5	Lecturing, video, demonstration field visit, group discussion, report writing	Formative (Objectives, quiz, question-answering, presentation), summative

Learning Materials

Recommended Readings	Berrie, A.M.M. 1977. An introduction to the Botany of major crop plants, Hyden& Sons Ltd. London. Bose, T.K. and Mitra,S.K. 1980. Fruits: Tropical & Subtropical. Nayaprakash, Calcutta, India. FAO, 1995. Fruit and Vegetable Processing. FAO Agricultural Service Bulletin 119. International Book Distributing Company, India. Gardner, V.E., Bradford, F.C. and Hooker, H.J. 1952. Fundamentals of Fruit production, McGraw Hill Book Co. New York. Hayes, W.D. 1960. Fruit Growing in India. Kitabistan, Allahabad.
Supplementary Readings	Mac Millan, H.F. 1989. A Handbook for Tropical Planting and Gardening. Scientific Publishers, Jodhpur, India. Macmillan, H.F. 1962. Tropical planting and gardening, Macmillan, London. Naik, K.C. 1963. South Indian Fruits & their culture. P. Varadachary& co. Madras. Samson, J. A. 1986. Tropical Fruits, Longman Group UK Ltd. Singh, A. 1980. Fruit physiology and production. Kalyani Pub. New Delhi. Singh, D.K. 2008. Hi-Tech Horticulture. Agrotech Publishing Academy, Udaipur, India. Singh, D.K. and Singh, S.K. 2005. Physiology and Postharvest management of Horticultural Crops. Agrotech Publishing Academy, Udaipur, India. Singh, N.P. 2007. Fruit and Vegetable Preservation. Oxford Book Company, Jaipur, India. Singh, R. 1961. Fruits. National Book Trust, New Delhi. Online Resources

Course Code: 0811 08 AT 4104		Year: Fourth	Term: First
Course Title	Pomology Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	Sufficient practical knowledge and skills on cultural practices, bearing habits, maturity indices and economic analysis of fruit production will be provided to the participants to ensure better management of orchard.		
Objective	To introduce the students with the practices and management of orchard along with economic analyses.		

	Course Contents/Tasks	CLOs
1	Identification of common fruit plants of Bangladesh.	1
2	Study of morphological features of fruit of Bangladesh.	1
3	Practices on field layout, planting, manuring, fertilizing, pruning, training and other intercultural operations of fruits.	2
4	Study on bearing habit of different fruit.	1
5	Estimation of cost of production of mango, banana, pineapple and papaya.	3
6	Performance record of fruit tree.	3
7	Maturity indices of fruits.	4
8	Visiting important orchards of Bangladesh.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify the fruits along with their morphology and bearing habit.	1, 2
	CLO2	Practice the field layout for planting, manuring, fertilizing, pruning, training and other intercultural operations of fruit crops.	2, 3, 9
	CLO3	Analyze the performance of fruit trees and economic aspects of growing fruit crops.	2, 5, 9
	CLO4	Determine the maturity indices of fruit.	2, 9
	CLO5	Gain practical knowledge through visiting orchard.	9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, video, demonstration	Formative (Quiz, active class participation), summative
CLO2	Demonstration, video	Formative (Active class participation, practical evaluation), summative
CLO3	Calculation, demonstration, discussion,	Formative (Quiz, practical evaluation), summative
CLO4	Demonstration, discussion	Formative (Quiz, active class participation, practical evaluation), summative
CLO5	Field visit	Formative (Report writing), summative

Learning Materials

Recommended Readings	Berrie, A.M.M. 1977. An introduction to the Botany of major crop plants, Hyden& Sons Ltd. London. Bose, T.K. and Mitra,S.K. 1980. Fruits: Tropical & Subtropical. Nayaprakash, Calcutta, India. FAO, 1995. Fruit and Vegetable Processing. FAO Agricultural Service Bulletin 119. International Book Distributing Company, India. Gardner, V.E., Bradford, F.C. and Hooker, H.J. 1952. Fundamentals of Fruit production, McGraw Hill Book Co. New York. Hayes, W.D. 1960. Fruit Growing in India. Kitabistan, Allahabad.
Supplementary Readings	Mac Millan, H.F. 1989. A Handbook for Tropical Planting and Gardening. Scientific Publishers, Jodhpur, India. Macmillan, H.F. 1962. Tropical planting and gardening, Macmillan, London. Naik, K.C. 1963. South Indian Fruits & their culture. P. Varadachary& co. Madras. Samson, J. A. 1986. Tropical Fruits, Longman Group UK Ltd. Singh, A. 1980. Fruit physiology and production. Kalyani Pub. New Delhi. Singh, D.K. 2008. Hi-Tech Horticulture. Agrotech Publishing Academy, Udaipur, India. Singh, D.K. and Singh, S.K. 2005. Physiology and Postharvest management of Horticultural Crops. Agrotech Publishing Academy, Udaipur, India. Singh, N.P. 2007. Fruit and Vegetable Preservation. Oxford Book Company, Jaipur, India. Singh, R. 1961. Fruits. National Book Trust, New Delhi. Online Resources

Course Code: 0811 08 AT 4105		Year: Fourth	Term: First
Course Title	Diseases of Horticultural Crops and Seed Pathology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course is designed to provide an orientation regarding mechanism of disease development, epidemiological aspects and management of fruit, vegetables, cash crop diseases, nursery diseases and introduction to seed pathology.		

	Course Contents	CLOs
	Section A	
1	Diseases of fruits: Mango, banana, papaya, coconut, pineapple, jackfruit, citrus and guava.	1, 2
2	Diseases of vegetables: Potato, tomato, sweet potato, cabbage, cauliflower, chili, brinjal, lady's finger, amaranth, cucurbits and beans.	1, 2
	Section B	CLOs
3	Diseases of cash crops: Tobacco, tea, betelnut, betelvine, turmeric, ginger, onion and garlic.	1, 4
4	Introduction to seed pathology: Importance of seed borne diseases in Bangladesh, significance and mechanism of seed transmission of pathogens, seed health testing methods, control of seed-borne diseases.	3, 4
5	Nursery diseases and disease of agroforest trees: Root rots, wilts and cankers of important forest trees.	3, 4
6	Crop loss assessment and disease forecasting.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Identify and analyze mechanism of dissemination of different diseases of fruits and vegetables.	1, 3
	CLO2	Relate the effect of different environmental factors on the development of specific disease.	1, 3
	CLO3	Characterize seed borne and seed transmitted diseases and select appropriate seed health testing method.	5, 10
	CLO4	Suggest appropriate method for control of fruits, vegetables and seed borne diseases and assess crop loss.	1, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, group discussion, presentation, assignment, specific disease case study, video	Quiz, assignment, active class participation, sudden test question and class test, viva voce and final exam
CLO2	Lecturing, group discussion, presentation, assignment, specific disease case study, video	Quiz, short questions, MCQ, presentation, assignment, active class participation, sudden class test, question-answering, viva voce and final exam
CLO3	Lecturing, group discussion, presentation, assignment, specific disease case study, video, prescription for disease control	Quiz, short questions, MCQ, presentation, assignment, active class participation, sudden class test, question-answering, viva voce and final exam
CLO4	Lecturing, group discussion, presentation, assignment, specific disease case study, video, prescription for disease control	Quiz, short questions, MCQ, presentation, assignment, active class participation, sudden class test, question-answering, viva voce and final exam

Learning Materials

Recommended Readings	Agrios, G.N. 1997. Plant Pathology. 4th ed., Academic Press, New York. Agrios, G.N. 2012. Plant Pathology. 5th ed., Academic press, New York. Ashrafuzzaman, M.H. 1976. A Lecture Guide to Crop Diseases. Department of Plant Pathology. BAU. Asrafuzzaman, M.H. 1991, A Text Book of Plant Pathology. Bangladesh Agricultural Res. Council, Dhaka. Boss, L. 1983. Introduction to plant virolology. Centre for Agricultural Publishing and Documentation, Wagenigen, Netherlands.
Supplementary Readings	Vashista, B.R. 2010. Botany for degree students' Fungi. S. Chand and company, New Delhi. Verma, H.K. 2012. A text book of Fungi. Random Publications. New Delhi. Dasgupta, K.M. 1998. Phytonematology. Nayaprokash, Calcutta. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw Hill Publishing Co., India. Mian, I.H. 1996. Introduction to Nematology. 2nd ed., Royea Begum, Gazipur, Bangladesh. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd ed., Oxford and IBH publishing co. pvt. Ltd. New Delhi. Rangaswami, G. 1972. Disease of Crop Plants in India. Prentice Hall of India Private Ltd. New Delhi. Rangswami, G. 1962. Bacterial Plant Diseases in India. Asia Publishing house, Bombay. Singh, R.S. 1994. Plant Diseases. 6th ed., Oxford and IBH Publishing Co. New Delhi. Singh, R.S. 1990. Plant disease, 7th ed., Oxford and IBH publishing co. pvt. Ltd. New Delhi. Singh, R.S. 2017. Introduction to Principles of Plant Pathology. 4th ed., CBS Publishers & Distributors, India. Wheeler, B.E.J. 1969. An Introduction to Plant Diseases, John Wiley and Sons Ltd.

Course Code: 0811 08 AT 4106	Year: Fourth	Term: First
Course Title	Diseases of Horticultural Crops and Seed Pathology Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	This course is oriented to provide practical knowledge about pathogenicity test, identification and preservation of fruits, vegetables and cash crop diseases, seed health test formulation and application of seed soil and foliar treating chemicals.	

	Course Contents/Tasks	CLOs
1	Demonstration of Koch's postulates by using following groups of pathogens: fungi, bacteria, nematodes & virus.	1
2	Field and laboratory studies of following plant diseases a) Detailed study i) Late blight and early blight of potato and tomato ii) Anthracnose of chili, lady's finger & amaranth iii) Alternaria leaf spot of cabbage & onion iv) Powdery and downy mildew of beans/cucurbits v) Rhizopus fruit rot of Jack fruit and nut vi) Brown spot and frogeye leaf spot of tobacco vii) Anthracnose and taphrina leaf spot of turmeric viii) Anthracnose/leaf spot of betelvine. b) Brief study i) Dry rot, hollow heart, black heart and scab of potato ii) Yellow vein clearing mosaic of lady's finger and little leaf of brinjal iii) Bud rot of coconut iv) Leaf spot of banana & coconut v) Papaya mosaic vi) Wilt of guava vii) Scab & die-back of lemon viii) Red rot of sugarcane ix) Tobacco mosaic x) Blister blight & grey blight of tea xi) Foot rot & leaf rot of betel vine xii) Seed rot & seed discoloration xiii) Damping-off & seedling blight.	2, 5
3	Seed health testing: dry infection, incubation method (Blotter & agar plate methods) and growing on test.	3
4	Chemical control: a) Handling of plant protection equipment's b) Preparation and application of foliar fungicides (Bordeaux mixture, Burgundy mixture) calculation of concentration, percentage of active ingredients, rates of application, etc. c) Students in groups are required to conduct a spray experiment with foliar fungicides for controlling a specific foliar disease of crop d) Seed and soil treatment e) Prescription for control of some important diseases.	4, 5
5	Field excursion for plant disease study: f) Each student is required to submit a comprehensive report on the prepared herbarium, spray experiment and field excursion.	2

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Apply koch's postulates by using fungi, bacteria, nematodes & viruses.	1, 5
	CLO2	Identify fruits, vegetables and cash crop diseases and causal organisms in the laboratory and field.	1, 2, 4
	CLO3	Test seed health by using different methods.	3
	CLO4	Calibrate and apply seed, soil and foliar fungicides.	9, 10
	CLO5	Prescribe control measures of important diseases.	5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, case study, individual disease demonstration	Assignment, active class participation, viva voce and final exam
CLO2	Lecturing, graph and pictorial discussion, group discussion, video, assignment, presentation, field visit for problem-based learning and give prescription	Quiz, short questions, MCQ, presentation, assignment, active class participation, viva voce and final exam
CLO3	Lecturing, group discussion, presentation, debate, assignment	Quiz, short questions, MCQ, presentation, viva voce and final exam
CLO4	Lecturing, group discussion, presentation, debate, assignment	Assignment, active class participation, viva voce and final exam
CLO5	Lecturing, prescription, group discussion, presentation	Assignment, active class participation, viva voce and final exam

Learning Materials

Recommended Readings	Agrios, G.N. 2012. Plant Pathology. 5th ed., Academic press, New York. Ashrafuzzaman, M.H. 1976. A Lecture Guide to Crop Diseases. Department of Plant Pathology. Asrafuzzaman, M.H. 1976. Laboratory Manual of Plant Pathology. Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh Barnett, H. L. and Hunter, B. B. 1972. Illustrated genera of imperfect fungi. 3rd ed. Burgess publishing company, USA.
Supplementary Readings	Vashista, B.R. 2010. Botany for degree students' Fungi. S. Chand and company, New Delhi. Verma, H.K. 2012. A text book of Fungi. Random Publications. New Delhi. Dhingra, O.D. and Sinclair, J.B. 1995. Basic Plant pathology methods. 2nd ed., Lewis publishers is an imprint of CRC press. Mian, I.H. 1995. Methods in Plant Pathology. IPSA-JICA Project Publication. Institute of Postgraduate Studies in Agriculture, Gazipur, Bangladesh.

Course Code: 0811 08 AT 4107		Year: Fourth	Term: First
Course Title	Stresses in Agriculture and Disaster Management		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course educates the learners about basic and applied knowledge on stresses and disaster in agriculture and their management.		
Objective	To provide knowledge to the students on stresses in agriculture and risk assessment, vulnerability analysis and disaster management planning.		

	Course Contents	CLOs
	Section A	
1	Introduction: Concept of stress and strain, stress tolerance, avoidance.	1, 2
2	Stresses in agriculture: Drought, heat, salinity, waterlogging; effect of these stresses on crops, crop responses and adaptation, management of these stresses from agronomic and breeding point of view.	1, 2
	Section B	CLOs
3	Disaster: Definition, concept, types and characteristics, causes and effects, impacts, consequences. Natural and manmade disaster (floods, cyclone, tornado); global view of disaster, disaster cycle, disaster prone areas in Bangladesh.	3
4	Climate change and disaster: Global warming, sea level rise, air pollution, water pollution and deforestation.	5
5	Hazards: Definition, concept, classification, difference and relationship between hazard and disaster.	4
6	Risk assessment and vulnerability analysis: Disaster risk, concept and elements, disaster risk reduction; risk assessment; Vulnerability: concept and parameters, relationship between risk and vulnerability, socio-economic factors of vulnerability, vulnerability analysis.	6
7	Disaster management planning: Concept and elements, preparedness and mitigation; Pre and post-disaster management, integrated planning for disaster management, technologies for disaster management; efforts to mitigate natural disasters at national and global levels.	7

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Conceptualize different stresses in agriculture explain crop response to stresses, adaptation and management.	1, 2
	CLO2	Explain crop response to stresses, adaptation and management.	1, 3
	CLO3	Characterize disaster.	3, 9
	CLO4	Evaluate the impact of disaster on Bangladesh agriculture.	5
	CLO5	Depict climate change and disaster.	5, 10
	CLO6	Assess risk and analyze vulnerability.	10
	CLO7	Propose disaster management planning.	10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion, video presentation	Viva voce and final exam
CLO4	Lecture and team teaching	Quiz and class test
CLO5	Problem-based learning and presentation	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecturing, discussion, demonstration, report writing	Assignment, quiz, presentation

Learning Materials

Recommended Readings	Ahmad, P. and Prasad, M.N.V. (eds.). 2012. Abiotic Stress Responses in Plants: Metabolism, Productivity and Sustainability, Springer. Blaikie, P., Cannon, T., Davis, L. and Wisner., B. 1994. At Risk: Natural Hazards, People's Vulnerability and Disasters. London: Routledge. Bryant, E. 2005. Natural Hazards, Cambridge University Press, U.K. Burton, I.R, Kates, W. and White, G.F. 1994. The Environment as Hazard. Harlow: Longman. Carter, W.N. 1991. Disaster Management, Asian Development Bank, Manila.
Supplementary Readings	Goel S.L. 2007. Disaster Administration and Management Text and Case Studies Deep &Deep Publication Pvt. Ltd., New Delhi. Gupta H.K. 2003. Disaster Management. Indian National Science Academy. Orient Black swan. Hirt, H. and Shinozaki, K. (eds.). 2004. Plant Responses to Abiotic Stress, Springer. Hodgkinson, P.E. and Stewart, M. 1999. Coping with Catastrophe: A Handbook of Disaster Management. Routledge. Jenks, M. A. and Hasegawa P.M. (eds). 2013. Plant Abiotic Stress. 2nd ed., Wiley-Blackwell. Sinha P.C. 2006. Disaster Mitigation: Preparedness, Recovery and Response. SBS Publication & Distributions Pvt. Ltd. New Delhi. Gaur, R.K. Sharma, P. (eds). 2013. Molecular Approaches in Plant Abiotic Stress. CRC Press Taylor & Francis Group.

Course Code: 0511 08 AT 4111	Year: Fourth	Term: First
Course Title	Biorational and Molecular Pest Management	
Course Status	Optional	
Credit	3.0	
Prerequisite(s)	None	
Rationale	The course intends to train up the students with updated knowledge of biorational and molecular approaches of pest management.	

	Course Contents	CLOs
	Section A	
1	Semiochemicals in pest management: Fundamentals, salient features of semiochemicals, classification of semiochemicals, mechanisms of semiochemical functioning, identification and behavioral characterization of semiochemicals, interaction of insects and plants semiochemicals, semiochemical formulations, semiochemical-based pest control techniques, potential use of semiochemicals in insect pest management, future advancement.	1
2	Insect Sterility Technique (IST): Elementary knowledge of IST, history of insect sterility, sterility principles, sterile insect supply, emergence, and release, sterile insect quality, strategic options of sit integration, kinds of insect sterility, major techniques of insect sterility, merits and demerits, biological and genetic bases of insect sterility, inherited sterility in insects, factors affecting insect sterility, usefulness and future perspectives.	2
3	Biological control: Overview, biological control strategies- classical biocontrol (importation), augmentative biocontrol (supplemental), conservation biocontrol, characteristics of predators and parasitoids, mode of actions of predators and parasitoids, rearing and releasing technique of predator and parasitoids, types of parasitoids and their role in pest management, microbial control of pest, salient features of entomopathogens – fungi, bacteria, nematode and virus, techniques of multiplication and field application, pros and cons of biocontrol agents, future perspective of biocontrol in pest management.	2
4	Biopesticides: Fundamentals, history of biopesticides, classes of biopesticides use of plants to manage pest – companion plants, repellent plants, barrier plants, indicator plants, trap plants, insectary plants, plant volatiles as attractants of herbivore natural enemies, plant defense traits – physical barriers, Secondary metabolites, and defense proteins, minerals and synthetics – kaolin clay, insecticidal soap, and iron phosphate, microbial pesticides – Bacillus thuringiensis, spinosad, nuclear polyhedrosis virus (NPV), Beauvaria bassiana, plant-derived botanicals – pyrethrin, azadiractin, neem oil, garlic, capsaicin, and vegetable oil, plant-incorporated-protectants (PIPs), nanobiopesticides, pros and cons of biopesticides and future perspective.	1
	Section B	CLOs
5	Insight to biotechnological insect resistance: Fundamentals, identification and genomic characterization of resistant genes, techniques of target gene transfer for resistance to insects, application of biotechnology for insect pest management, bacillus thuringiensis (Bt), resistance management principles for Bt crops, protease inhibitors, Secondary plant metabolites, alpha amylase inhibitors, plant lectin, future of transgenic crops for insect pest management.	3, 2
6	Molecular approaches for insect pest management: Introduction, classical approach through host-plant resistance, gene deployment, gene pyramiding, marker-assisted selection, novel approaches through genomics – RNAi technique for insect resistance, genome editing approach for insect resistance, usefulness and future perspectives of molecular pest management.	4
7	Molecular pest-plant interactions: Plant perception and signaling, systemic regulation of defenses, damage-associated molecular patterns, pattern recognition receptors, jasmonic acid JA/ ethylene ET signaling pathway, salicylic acid SA pathway, role of beneficial soil microbes in JA/ET signaling, effector triggered immunity ETI, pattern triggered immunity PTI, Flor theory of pest resistance and susceptibility, usefulness and future perspective.	4

	Course Contents	CLOs
	Section B	
8	Recent Advances in Molecular Marker Techniques: Introduction, elementary of molecular marker technology, SNP genotyping technologies, microarray-based genotyping, next generation sequencing (NGS) technology, genotype by sequencing (GBS) library, NGS for marker discovery, amplicon sequencing, marker discovery through RNA-seq, QTL mapping with high-throughput marker genotyping, genome-wide association mapping and genomic selection with NGS derived markers, significance in molecular pest management.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Formulate the manufacturing procedure of semiochemicals and biopesticides and analyze the factors influencing the effectivity of them.	1, 2, 7, 9
	CLO2	Explain insect sterility techniques and bioagents based pest management.	1, 2, 7
	CLO3	Design the construct of developing pest resistant model plants as well as discuss the different biotechnological and molecular approaches of pest management.	1, 6, 7, 9
	CLO4	Interpret pest-plant interaction at molecular level and evaluate the effective advance molecular strategies of developing pest resistant plant.	1, 2, 6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, brain storming and problem solving	Quiz, class test, assignment and final exam
CLO2	Lecture, group discussion, brain storming and problem solving	Presentation, class test, quiz, assignment and final exam
CLO3	Lecture, group discussion, brain storming and problem solving	Class test, viva voce, report wring and final exam
CLO4	Lecture, group discussion, brain storming and problem solving	Quiz, assignment, class test and final exam

Learning Materials

Recommended Readings	Khan, M.A. and Ahmad, W. 2019. Microbes for Sustainable Insect Pest Management: An Eco-friendly Approach - Volume 1. Springer, Netherlands. Dyck, V.A., Hendrichs, J. and Robinson, A.S. 2021. Sterile Insect Technique: Principles and Practice in Area-Wide Integrated Pest Management. CRC Press, Routledge, New York, United States. Chakravarthy, A.K. 2015. New Horizons in Insect Science: Towards Sustainable Pest Management. Springer, Netherlands.
Supplementary Readings	Hoffmann, K.H. 2015. Insect Molecular Biology and Ecology. Routledge, Taylor and Francis, New York, United States. Gilbert, L.I. 2011. Insect Molecular Biology and Biochemistry. Academic Press, Cambridge, Massachusetts, USA. Hoy, M. 2018. Insect Molecular Genetics: An Introduction to Principles and Applications, 4th ed. Elsevier, Amsterdam, Netherlands. Kumar, D. and Gong, C. 2018. Trends in Insect Molecular Biology and Biotechnology. Elsevier, Amsterdam, Netherlands.

Course Code: 0511 08 AT 4112		Year: Fourth	Term: First
Course Title	Biorational and Molecular Pest Management Sessional and Fieldwork		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course intends to provide the learners with hands-on training of collecting and preparing biorational and molecular products of pest management.		

	Course Contents/Tasks	CLOs
1	Collection, preparation and formulation of insect semiochemicals.	1
2	Demonstration of manufacturing techniques of insect sexpheromones.	1
3	Operation, maintenance and safety measures of using molecular approaches of pest management.	2
4	Collection, augmentation and conservation techniques of biocontrol agents.	
5	Preparation, precautions and calibration of biopesticide formulations and determination of their doses in field conditions.	2
6	Bioinformatics orientation of analyzing sequenced data in NCBI.	3
6	Observation of insect sterility techniques in BARI Entomology.	4
7	Field trips.	2, 3, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Collect and prepare insects to synthesize semiochemicals including sexpheromones.	1, 4, 9
	CLO2	Calibrate the dose and apply biopesticides and semiochemicals in field.	1, 2, 7, 9
	CLO3	Conduct basic bioinformatics analyses of sequenced data deposited in NCBI Genbank.	1, 4, 9
	CLO4	Design the molecular construct of developing pest resistant model plant.	2, 7, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Demonstration, group discussion, case study and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO2	Lecture, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO3	Lecture, group discussion, demonstration, and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO4	Lecture, demonstration, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO5	Lecture, group discussion, brain storming and case study	Quiz, evaluation of laboratory and fieldworks and sessional final

Learning Materials

Recommended Readings	Khan, M.A. and Ahmad, W. 2019. Microbes for Sustainable Insect Pest Management: An Eco-friendly Approach - Volume 1. Springer, Netherlands. Dyck, V.A., Hendrichs, J. and Robinson, A.S. 2021. Sterile Insect Technique: Principles and Practice in Area-Wide Integrated Pest Management. CRC Press, Routledge, New York, United States. Chakravarthy, A.K. 2015. New Horizons in Insect Science: Towards Sustainable Pest Management. Springer, Netherlands.
Supplementary Readings	Hoffmann, K.H. 2015. Insect Molecular Biology and Ecology. Routledge, Taylor and Francis, New York, United States. Gilbert, L.I. 2011. Insect Molecular Biology and Biochemistry. Academic Press, Cambridge, Massachusetts, USA. Hoy, M. 2018. Insect Molecular Genetics: An Introduction to Principles and Applications, 4th ed. Elsevier, Amsterdam, Netherlands. Kumar, D. and Gong, C. 2018. Trends in Insect Molecular Biology and Biotechnology. Elsevier, Amsterdam, Netherlands.

Course Code: 0811 08 AT 4114		Year: Fourth	Term: First
Course Title	Thesis		
Course Status	Capstone		
Credit	6.0		
Prerequisite(s)	None		
Rationale	It depicts the problem, issues and assumptions, regarding agriculture through data collection and analysis with a conclusion or recommendation.		
Course Objectives	• To collect and analyze data by appropriate conceptual framework; • To conclude and recommend based on observation and results • Review of relevant literature or scientific publications on a selected issue of agriculture and or conduct of good and time demanding research • Logic and organization: problem well defined, rationale clearly stated; Methods clearly described;		

	Course Contents/Tasks	CLOs
1	Problem identification and preparation research project.	1
2	Communication with the Research Supervisor and Co-supervisor (if any).	1, 2
3	Methods of data collection and analysis for laboratory and field experiments.	2, 3
4	Logical data presentation skill with statistical notation.	3
5	Thesis writing and submission for partial fulfillment of the degree.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Find a research problem.	1, 5
	CLO2	Prepare a research project proposal followed by laboratory or field experiment.	1, 3, 5
	CLO3	Perform critical thinking in research during report writing	7, 10
	CLO4	Draw Conclusion and recommendation based on facts and findings.	11, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and presentation	Report assessment and viva voce
CLO2	Lecture and presentation	Report assessment and viva voce
CLO3	Lecture and presentation	Report assessment and viva voce
CLO4	Field visit to different forests and relevant organizations	Report assessment and viva voce

Learning Materials

Recommended Readings	As reported for various courses.

Course Code: 0811 08 AT 4116		Year: Fourth	Term: First
Course Title	Project		
Course Status	Capstone		
Credit	3.0		
Prerequisite(s)	None		
Rationale	It depicts the problem, issues and assumptions, regarding agriculture through data collection and analysis with a conclusion or recommendation.		
Course Objectives	• To collect and analyze data by appropriate conceptual framework • To conclude and recommend based on observation and results • Review of relevant literature or scientific publications on a selected issue of agriculture and or conduct of good and time demanding research • Logic and organization: problem well defined, rationale clearly stated; Methods clearly described		

	Course Contents/Tasks	CLOs
1	Problem identification and preparation research project.	1, 2, 3
2	Communication with the Research Supervisor and Co-supervisor (if any).	1, 2
3	Methods of data collection and analysis for laboratory and field experiments.	1, 2
4	Logical data presentation skill with statistical notation.	1, 2, 3
5	Report writing and submission for partial fulfillment of the degree.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Find a research problem.	1, 5
	CLO2	Prepare a research project proposal followed by data collection and analysis.	1, 3, 5
	CLO3	Develop information communication and dissemination skill.	7, 10
	CLO4	Prepare final report based on conclusion and recommendation of the facts and findings.	9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and presentation	Report assessment
CLO2	Lecture and presentation	Assignment and viva voce
CLO3	Lecture and presentation	Report assessment and viva voce
CLO4	Field visit to different forests and relevant organizations	Report assessment and viva voce

Learning Materials

Recommended Readings	As reported for various courses.

Course Code: 0811 08 AT 4118	Year: Fourth	Term: First
Course Title	Internship	
Course Status	Capstone	
Credit	3.0	
Prerequisite(s)	None	
Rationale	This course will provide opportunities to the students to achieve practical experiences in agricultural sectors through participating different seminar, workshop and training arranged by government, non-government, private, international organization.	
Course Objectives	• To assist the students to further develop their technical, academic and workplace experiences, skills and abilities. • To apply the attained knowledge and skills to solve the relevant field level problems to meet the needs of the country.	

	Course Contents/Tasks	CLOs
1	Participation in practical assignments (research works/ teaching and research works/office services/field level management works) related to selected agricultural sectors.	1, 2, 3
2	Preparing an internship report based on gained working experiences.	3, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Familiarize with the formal working environment in agricultural sectors.	1, 2
	CLO2	Conduct systematic research on any agricultural problem with possible solution.	1, 2, 7
	CLO3	Manage office works as well as operate field level works.	1, 5
	CLO4	Write an internship report.	11, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Field visit to different agricultural organizations	Assignment
CLO2	Field visit to different agricultural organizations	Report assessment
CLO3	Field visit to agricultural organizations	Report assessment and viva voce
CLO4	Lecture and presentation	Report assessment and viva voce

Learning Materials

Recommended Readings	As reported for various courses.

Course Code: 0321 08 MCJ 4151	Year: Fourth	Term: First
Course Title	Agricultural Journalism	
Course Status	Optional	
Credit	3.0	
Prerequisite(s)	None	
Rationale	Agricultural journalism helps increasefarmers' consciousness in decision-making and to do the right thing at the right time. In this digital age, electronic agriculture (e-agriculture) has already acclaimed popularity among farmers.	

Course Contents		CLOs
Section A		
1	Introduction to agricultural communications: Introduction to agricultural communication, its history, role in society, and especially its unique role in agriculture; the foundation for an understanding of agricultural news and information.	1
2	Journalism concepts for agriculture: The role of the news media in covering government, the court systems, corporations, taxation, and insurance; a practical perspective on how journalists interact with public and private institutions from a legal, ethical and social standpoint.	1
3	The practice of agricultural public relations: Public relations between agricultural producers and their suppliers as a critical part of agricultural communication; public relations objectives, strategies, tactics, evaluation and execution. Practice interview, panel discussion, and round table.	1
Section B		CLOs
4	Agricultural photography: Develop knowledge of photography, editing software, and composition techniques used in the agricultural communications field. Develop photography and photo editing skills.	4
5	Agricultural media writing: Newsgathering, writing, editing and ethics for current and emerging mediums used in agricultural communication.	2
6	Communicating agricultural information to the public: Use of agricultural journalism principles and techniques to communicate scientific information related to agriculture, agribusiness, natural resources and life sciences to the general public.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Conceptualize agricultural journalism.	1
	CLO2	Become a good report writer contribute to the editorial process of reporting.	11
	CLO3	Contribute to attractive report writing.	11
	CLO4	Efficiently reporting in radio and TV.	11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion, report writing	Assignment, viva voce and final exam
CLO4	Lecture and group discussion, report writing	Assignment, viva voce and final exam

Learning Materials

Recommended Readings	Telg, R., and Irani, T. 2012. Agricultural Communications in Action; A Hands-On Approach.Clifton Park, New York. The Associated Press. 2019. The Associated Press Stylebook 2019: Briefing on Media Law. Basic Books. Anonymous. 1987. Communication handbook. Agriculture and communication review. Iowa. Aster, J.J. 1988. Art of Modern Journalism. Akashdeep. New Delhi, India.
Supplementary Readings	Relevant other books/ study materials would be provided by the Course Instructor during the teaching period. Agricultural Journalism PDF – INFOLEARNERS. Agricultural Journalism (Apr 10, 2014 ed.) | Open Library. Finch, P. 1987. How to publish yourself- A practical guide. Allison and Busby. London. Fox, R. 1952. Agricultural technical journalism. Prentice Hall. New York. Friedlander, F.J. and Lee, J. 1992. Feature writing for newspapers and magazines- Pursuit of excellence, Hosper and Row, London.

Course Code: 0111 08 IER 4154		Year: Fourth	Term: First
Course Title	Agricultural Study Tour and Field Visit		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	As a student of agriculture, practical experiences on various research activities along with the job functions and responsibilities of NARS institutes and cropping patterns in different agro-ecological zones is very much essential so that after graduation the learners can fit them to the respective contexts. This course is designed to enrich and broaden the practical experiences and functions of different NARS institutes and the existing cropping patterns in different agro-ecological zone (AEZ) of Bangladesh.		

	Course Contents/Tasks	CLOs
1	Visit to Bangladesh Agricultural Research Council (BARC), Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Wheat Research Institute (BWRI), Bangladesh Jute Research Institute (BJRI) , Bangladesh Sugar Crops Research Institute (BSCRI), Bangladesh Cotton Development Board (BCDB), Bangladesh Agricultural Development Corporation (BADC), Bangladesh Institute of Nuclear Agriculture (BINA), Bangladesh Livestock Research Institute (BLRI), Soil Resource and Development Institute (SRDI), Tea Research Institute (TRI), soil and planatation in Jaflong and Ratargul, Seed Certification Agency (SCA), Youth Development Centre, Rural Development Academy (RDA), Bangladesh Sericulture Research and Training Institute (BSRTI), Mango Research Institute (MRI), Spices Research Centre (SRC) (both head office and regional stations), Ramu Rubber Bagan, Hill Agricultural Research Stations, Hill Cotton Research Center, Jhum cultivation on hilly areas, soil texture, structure and plantation pattern in coastal basins of Potuakhali, St Martin Island and Cox's Bazar and different agricultural universities of Bangladesh.	1, 5
2	Field visit and gather practical experiences on cropping patterns and regional variation of crop productions of different agro-ecological zones.	2, 5
3	Visit to different irrigation projects of Bangladesh.	3, 5
4	Visit to different sugar mills, pesticide and fertilizer factories.	4, 5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Assess research activities of NARS research institutes.	1, 2, 3, 5, 7, 9, 11
	CLO2	Characterize different agroecological zones with crops grown therein.	1, 2, 3, 5, 7, 9, 11
	CLO3	Narrate irrigation practices of large irrigation projects.	1, 2, 3, 5, 7, 9, 11
	CLO4	Value operational procedure of agro-industries.	1, 2, 3, 5, 7, 9, 11
	CLO5	Prepare and present field visit and study tour report.	1, 2, 3, 5, 7, 9, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Visit, demonstration, presentation	Report writing, viva, presentation
CLO2	Field visit, discussion, video presentation, demonstration	Report writing, viva, presentation
CLO3	Field visit, discussion, demonstration	Report writing, viva, presentation
CLO4	Study tour, discussion, demonstration	Report writing, viva, presentation
CLO5	Lecturing, field visit, presentation	Report writing, viva, presentation

Learning Materials

Recommended Readings	As reported for various courses.

Course Code: 0418 08 BA 4159		Year: Fourth	Term: First
Course Title	Agribusiness and Entrepreneurship Development		
Course Status	Optional		
Credit	2.0		
Prerequisite(s)	None		
Rationale	The course is designed to provide knowledge on agribusiness and the development of entrepreneurship skills in the agriculture sector.		
Objectives	To enable the students to identify the opportunities for self-employment. To motivate and make the graduates ready to take risks involved in starting a new venture.		

	Course Contents	CLOs
	Section A	
1	Socioeconomic background/conditions of Bangladesh. Nature and economic significance of agribusiness. Status of agriculture in Bangladesh in terms of demand and supply. Problems of agricultural produce marketing in Bangladesh.	1
2	State of agribusiness in Bangladesh in terms of diversity and value addition. Entrepreneurship in economic development. Education and career in entrepreneurship. Factors affecting entrepreneurial growth.	1
3	Entrepreneurship development program. Entrepreneurship development policy. SMEs: significance in the economy, issues and challenges, international business.	2
	Section B	CLOs
4	Developing entrepreneurial competencies, Social and ethical responsibilities, Entrepreneurial motivation, Entrepreneurial mind, and opportunity analysis.	4
5	Creativity and generating idea(s), Transforming ideas into business opportunities, Understanding business plan, Marketing plan, and financial plan.	2
6	Organizational plan, Market research, Product planning and development process, Developing marketing/business plan, Enterprise and SME visit.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	State necessity of development of agribusiness sector in Bangladesh.	3
	CLO2	Design agriculture marketing system and motivate people to involve in agribusiness.	5
	CLO3	Develop entrepreneurship skill and identify the scope of SMEs in agribusiness.	5, 6
	CLO4	Determine the suitable entrepreneurial opportunities and generate ideas using creative techniques.	3
	CLO5	Recognize the components of a business plan, develop the marketing plan and articulate the human resource aspects of an entrepreneurial venture.	7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Problem-based learning and presentation	Assignment and final exam
CLO5	Lecture and group discussion	Viva voce and final exam

Learning Materials

Recommended Readings	Bangladesh Economic Survey Reports. Hisrich, Robert; Entrepreneurship Development, McGraw Hill, NY. Industrial Policy, Ministry of Industry, GOB. Khanka, S.S. 2006. Entrepreneurial Development, S. Chand & Company Ltd. New Delhi
Supplementary Readings	Reddy, M.V.S., Naik, R.G. and Shivalingaiah, Y.N. 2021. AgriBusiness Management and Entrepreneurship Development: Based on the 5th Deans' Committee Recommendations. Brillion Publication. Yuvaraja, N. 2021. Entrepreneurship Development and AgriBusiness Management. Brillion Publication. Agribusiness and rural entrepreneurship development | UNIDO. Agribusiness and Entrepreneurship development - Department of Development and Strategic Studies | Sokoine University of Agriculture (sua.ac.tz). Agricultural Entrepreneurship and Agribusiness – Sasakawa Africa Association (sasakawaeducation.org).

Fourth Year Second Term			
Course Code: 0811 08 AT 4201		Year: Fourth	Term: Second
Course Title	Cropping Systems and Sustainable Agriculture		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	This course provides different aspects of cropping system, crop forecasting and sustainable agriculture.		

	Course Contents	CLOs
	Section A	
1	Cropping scheme: Concept, objectives and principles of preparation.	2
2	Cropping systems: Concept, types and determinants.	1
3	Cropping pattern: Concept; factors affecting cropping pattern; basic information about the major cropping patterns of Bangladesh and ways of their improvement; efficiency in cropping system, interaction in intercropping and sequential cropping.	1, 5
4	Multiple cropping: Prerequisites and potentials; sequential cropping and intercropping with their advantages and disadvantages; criteria for selection of intercrop components; land equivalent ratio (LER); relative yield total (RYT), crop equivalent yield (CEY), multiple cropping index (MCI).	2
5	Crop rotation: Objectives, principles; advantages and limitations.	2
	Section B	CLOs
6	Crop forecasting: Objectives; factors considered during forecasting; crop reporting-concepts, objectives, methods and preparation of report.	3
7	Sustainable agriculture: Concept; differences from modern agriculture; problems of modern agriculture; management practices for sustainable agriculture; advantages and limitations; indices of sustainability-priority, total factor productivity; concept, components, advantages and limitations of conservation agriculture.	4
8	Organic farming: Definition, objectives, principles and components; organic production requirement-organic manures, vermicompost, bio-fertilizers; low input organic farming.	4
9	Conservation agriculture: Concept, components, advantages and limitations of practicing conservation agriculture in Bangladesh.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe cropping systems and cropping patterns of Bangladesh, and provide necessary suggestions for improvement.	1, 2, 3, 4, 5
	CLO2	Explain cropping scheme, multiple cropping and crop rotation.	1, 2, 4, 5
	CLO3	Analyze the present crop condition and forecast the incidence of pests and expected yield of crops.	1, 2, 4, 5
	CLO4	Compare sustainable agriculture and modern agriculture.	1, 2, 3, 5
	CLO5	Assess land utilization pattern and crop statistics of Bangladesh.	1, 2, 3, 5, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, demonstration, field visit, group discussion	Continuous assessment (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO2	Lecturing, discussion, demonstration	Continuous assessment (Formative: Quiz, active class participation, objective, question-answering) and summative (Term final)
CLO3	Group discussion, demonstration, debate	Continuous assessment (Formative: Objectives, quiz, question-answering, group discussion, presentation) and summative (Term final)
CLO4	Group discussion, demonstration, debate	Continuous assessment (Formative: Short questions, presentation) and summative (term final)
CLO5	Lecturing, demonstration, field visit, group discussion	Continuous assessment (Formative: Short questions) and summative (Term final)

Learning Materials

Recommended Readings	Chandrasekaran, B., Annadurai, K. and Somasundaram, E. 2010. A Text of Agronomy. Ansari Road, Daryaganj, New Delhi. Chaterjee, B.W., Maiti, S. and Manadal, B.K. 1989. Cropping System (Theory and Practical). Oxford & IBH Pub., Co. Pvt. Ltd. New Delhi. Das, P.C. 1995. Principles and Practices of Crop Production. South Asia Pub., Delhi. De, G.C. 1997. Fundamentals of Agronomy. Oxford & IBH Pub., Co. Pvt. Ltd. New Delhi.
Supplementary Readings	Iqbal, T.M.T., Alam. M.S. and Gaffer M.A. 1986. Krishitatta: Khamar O Khamar Babosthapana (In Bangla). Sara Alam, Dhaka. Karim, M.M., Samad, M.A. and Alam, A.B.M. 1996. Math Fosol Utpadoner Moulnity O Khamar Bebosthya (Bangla). Bangladesh Open University, Gazipur, Bangladesh. Reddy, T.Y. and Reddy, G.H. 2011. Principles of agronomy. Kalyani Publishers, New Delhi. Singh. S.S. 1998. Principles and Practices of Agronomy. Kalyani Publishers, New Delhi.

Course Code: 0811 08 AT 4202		Year: Fourth	Term: Second
Course Title	Cropping Systems and Sustainable Agriculture Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course provides practical aspects of cropping systems, land utilization and crop forecasting.		

	Course Contents/Tasks	CLOs
1	Graphical representation of land utilization and crop statistics in Bangladesh.	1
2	Layout of an agricultural farm.	2
3	Maintenance of farm records and preparation of cropping scheme.	3
4	Preparation of crop rotation schedules.	4
5	Preparation of crop calendar.	4
6	Undertaking crop cutting experiment.	5
7	Preparation of crop report.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Judge land utilization pattern and crop statistics in Bangladesh.	1, 2, 9, 10
	CLO2	Design an agricultural farm.	1, 2, 3, 9, 10
	CLO3	Maintain farm records.	1, 2, 3, 9
	CLO4	Prepare crop calendar, crop report and crop rotation schedule.	1, 2, 9, 10
	CLO5	Conduct crop cutting experiment for estimation of production.	1, 2, 3, 9, 10

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, discussion, demonstration	Sessional assessment (Formative: Quiz, objectives, active class participation and viva)
CLO2	Lecturing, video, field visit	Sessional assessment (Formative: Quiz, short questions, MCQ, presentation and viva)
CLO3	Lecturing, demonstration field visit, group discussion, report writing	Sessional assessment (Formative: Quiz, objective, active class participation and viva)
CLO4	Lecturing, demonstration field visit, group discussion, report writing	Sessional assessment (Formative: Quiz, objective, active class participation and viva)
CLO5	Lecturing, demonstration field visit, group discussion, report writing	Sessional assessment (Formative: Quiz, objective, active class participation and viva)

Learning Materials

Recommended Readings	Chandrasekaran, B., Annadurai, K. and Somasundaram, E. 2010. A Text of Agronomy. Ansari Road, Daryaganj, New Delhi. Chaterjee, B.W., Maiti, S. and Manadal, B.K. 1989. Cropping System (Theory and Practical). Oxford & IBH Pub., Co. Pvt. Ltd. New Delhi. Das, P.C. 1995. Principles and Practices of Crop Production. South Asia Pub., Delhi. De, G.C. 1997. Fundamentals of Agronomy. Oxford & IBH Pub., Co. Pvt. Ltd. New Delhi.
Supplementary Readings	Iqbal, T.M.T., Alam. M.S. and Gaffer M.A. 1986. Krishitatta: Khamar O Khamar Babosthapana (In Bangla). Sara Alam, Dhaka. Karim, M.M., Samad, M.A. and Alam, A.B.M. 1996. Math Fosol Utpadoner Moulnity O Khamar Bebosthya (Bangla). Bangladesh Open University, Gazipur, Bangladesh. Reddy, T.Y. and Reddy, G.H. 2011. Principles of agronomy. Kalyani Publishers, New Delhi. Singh. S.S. 1998. Principles and Practices of Agronomy. Kalyani Publishers, New Delhi.

Course Code: 0811 08 AT 4203		Year: Fourth	Term: Second
Course Title	Soil Fertility Management		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course intends to provide practical knowledge about the management of soil fertility and soil productivity for sustainable crop production.		

	Course Contents	CLOs
	Section A	
1	Soil fertility: Introduction to soil fertility and soil productivity; factors affecting soil fertility; evaluation and maintenance of soil fertility.	1
2	Soil reaction and liming: Causes of soil acidity and alkalinity; buffering capacity of soil; liming materials; effects of liming on soil properties; factors regarding lime requirement in soil; soil reaction affecting nutrient availability.	2
3	Plant nutrients: Mechanisms of nutrient uptake by plants; comprehensive study about N, P, K, S and Zn fertilizers.	2
4	Biological Nitrogen Fixation (BNF): Definition, agents and factors of BNF; importance and production of Azolla and blue green algae in agriculture; biofertilizers- concepts, method of application, their role in crop production and maintenance of soil fertility.	3
	Section B	CLOs
5	Soil colloids and clay mineralogy: Definition, classification and properties of soil colloids; classification, structure and characteristics of clay minerals (kaolinite, montmorillonite, illite, mica, vericullite and interstratified minerals).	4
6	Ion exchange: Definition, mechanism and importance; base saturation.	4
7	Organic matter: Sources and composition; definition and formation of humus; C-N ratio; effect of organic matter on soil properties.	3
8	Chemistry of submerged soils: Characteristics of submerged soils; redox potential; pH; transformation of N, P, S, Zn and Fe in submerged soils.	5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain soil fertility and soil productivity with its maintenance.	1, 2, 5
	CLO2	Characterize soil acidity, liming and the mechanism of nutrients uptake by plants.	1, 3
	CLO3	Narrate the importance of bnf, biofertilizer, organic matter and humus in crop production.	1, 3, 6, 12
	CLO4	Illustrate soil colloid, clay minerals, ion exchange and its importance in crop production.	1, 2
	CLO5	Describe the transformation of nutrients with soil submergence.	1, 3

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration	Continuous (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO2	Lecture, video	Continuous (Formative: Quiz, objectives, active class participation) and summative (Term final)
CLO3	Lecture, group discussion, presentation	Continuous (Formative: Viva, presentation, active class participation) and summative (Term final)
CLO4	Lecture and field visit	Continuous (Formative: Assignment, active class participation) and summative (Term final)
CLO5	Lecture	Continuous (Formative: Quiz, assignment, Active class participation) and summative (Term final)

Learning Materials

Recommended Readings	Brady, N.C. 1990. Nature and properties of soils. 10th ed. macmillian publishing co. inc., New York. Biswas, T.D. and Mukherjee, S.K. 1987. Text Book of Soil Science. Tata mcgraw hill publishing co., New Delhi. Das, D.K. 1997. Introductory Soil Ccience. Kalyani Publishers, New Delhi. Foth, H.D. and Turk, L. M. 1972. Fundamental of soil science. 5th ed., Wiley eastern pvt. ltd., New Delhi. Indian Society of Soil Science (ISSS). 2012. Fundamentals of Soil Science. Indian Society of Soil Science, New Delhi.
Supplementary Readings	Gupta, P.K. 2007. Soil, Plant, Water and Fertilizer Analysis. Agrobios, Jodpur, india. Jaiswal, P.C. 2006. Soil, Plant and Water Analysis. 2nd ed., Kalyani Publishers, ludhiyana. Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. 1995. Soil Fertility and Fertilisers. 5th ed., Macmillan Publishing Company, USA.

Course Code: 0811 08 AT 4204		Year: Fourth	Term: Second
Course Title	Soil Fertility Management Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is planned to provide practical and applied knowledge on different essential plant nutrients including different techniques of their analysis.		

	Course Contents/Tasks	CLOs
1	Estimation of soil organic carbon and estimation of organic matter.	1
2	Determination of N, P, K and EC in soil.	2
3	Observation of nutrient deficiency in soil.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Estimate organic matter and organic carbon in soil.	1, 3
	CLO2	Determine different plant nutrients from soil.	1, 2, 12
	CLO3	Demonstrate nutrient deficiency symptoms in plants.	1, 6, 9, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, group discussion, field visit	Continuous (Formative: Viva, active class participation, report writing) and summative (Term final)
CLO2	Lecture, demonstration, field visit	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)
CLO3	Lecture, demonstration, field visit	Continuous (Formative: Viva, active class participation, assignment) and summative (Term final)

Learning Materials

Recommended Readings	Brady, N.C. 1990. Nature and properties of soils. 10th ed. macmillian publishing co. inc., New York. Biswas, T.D. and Mukherjee, S.K. 1987. Text Book of Soil Science. Tata mcgraw hill publishing co., New Delhi. Das, D.K. 1997. Introductory Soil Ccience. Kalyani Publishers, New Delhi. Foth, H.D. and Turk, L. M. 1972. Fundamental of soil science. 5th ed., Wiley eastern pvt. ltd., New Delhi. Indian Society of Soil Science (ISSS). 2012. Fundamentals of Soil Science. Indian Society of Soil Science, New Delhi.
Supplementary Readings	Gupta, P.K. 2007. Soil, Plant, Water and Fertilizer Analysis. Agrobios, Jodpur, india. Jaiswal, P.C. 2006. Soil, Plant and Water Analysis. 2nd ed., Kalyani Publishers, ludhiyana. Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. 1995. Soil Fertility and Fertilisers. 5th Ed., Macmillan Publishing Company, USA.

Course Code: 0811 08 AT 4205		Year: Fourth	Term: Second
Course Title	Plant Biotechnology		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is assigned to provide fundamental knowledge of plant biotechnology and its scope of application in agriculture.		

	Course Contents	CLOs
	Section A	
1	Introduction to plant biotechnology: Concept, history, areas and branches; scope and prospects, status of biotechnology in Bangladesh.	1
2	Plant cell and tissue culture: Principles and applications: cell theory, cellular totipotency, cellular differentiation, morphogenesis and regeneration, tissue culture techniques, types and applications	1, 2
3	Callus and cell suspension culture: Callus culture: definition, types, formation and characteristics of callus tissue, factors affecting callus formation, significance of callus. Cell suspension culture: Initiation and maintenance, types of suspension culture, utility of suspension culture, single cell culture and cell plating.	3, 4
4	Somaclonal and gametoclonal variations: Types, origin, applications, advantages, limitations, achievements.	3, 4
5	Micropropagation: Procedure, applications, advantages and limitations of shoot tip and meristem culture.	3, 4
6	Zygotic embryo culture: Purpose, methods, procedure, applications, achievements, ovule culture and ovary culture.	3, 4
7	Anther and pollen culture and haploid production: Principle and importance of anther and pollen culture; process of androgenesis, types and significance of haploids.	3, 4
8	Protoplast culture and somatic hybridization: Protoplast isolation, culture, fusion and somatic hybridization; cybrid production, application and achievements, advantages and disadvantages.	3, 4
	Section B	CLOs
9	Genetic engineering: Concept, scope and importance of genetic engineering.	1
10	PCR technology: Concept, steps, components, amplification of PCR, application of PCR.	5
11	Recombinant DNA technology: Purpose and basic concept of recombinant DNA technology, restriction enzymes, vectors, gene cloning, identification of recombinant molecule and applications, concept and construction of cDNA and genomic library, DNA and RNA hybridization techniques, principles of DNA sequencing.	6
12	Transgenic breeding: Selectable markers, methods of gene transfer- direct and indirect, transgenic plants-main features, transgenic vs. conventional breeding.	6
13	Marker aided selection: DNA markers, marker aided selection, merits and demerits, molecular mapping, DNA fingerprinting	6

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Describe different aspects of plant biotechnology.	2
	CLO2	Use plant tissue culture techniques in breeding new crop varieties.	1, 2, 5
	CLO3	Explain how the Polymerase Chain Reaction (PCR) is used for engineering.	2
	CLO4	Explain what a genetically modified organism (GMO) is and how is it made.	2
	CLO5	Illustrate the method of making cDNA and genomic libraries.	2
	CLO6	Apply DNA markers for the selection of desirable plants.	1, 2, 5, 6

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment
CLO2	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment
CLO3	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment
CLO4	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment
CLO4	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment
CLO6	Lecture, assignment, group discussion, tutorial	Written examination, quiz, assignment

Learning Materials

Recommended Readings	Abbot, D. 2013. Recent Advances in Plant tissue culture and Biotechnology. Random Pub. India. Chawla, H.S. 2005. Introduction to Plant Biotechnology. 2nd ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. George, A. 2005. Understanding Biotechnology: An Integrated and Cyber-Based Approach. Pearson Education Ltd., India. Gupta, P.K. 1999. Cell and Molecular Biology. Rastogy Publishers, Meerut, India.
Supplementary Readings	Narayanswamy, S. 1999. Plant Cell and Tissue Culture. Tata McGraw-Hill Publishing Company Limited, New Delhi. Nicholl, D.S.T. 2013. An Introduction to Genetic Engineering. CUP, India. Rastogy, S.C. 2005. Cell Biology. New Age International Publishers, New Delhi. Razdan, M.K. 2008. An Introduction to Plant Tissue Culture. 2nd ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi/Calcutta, India. Sadava, D.E. 1993. Cell Biology: Organells Structure and Function. Jones and Bartlett Publishers, Boston, London. Tong-Jen, F. 2009. Plant Cell and Tissue Culture for the Production of Food Ingredients. Springer, India.

Course Code: 0811 08 AT 4206		Year: Fourth	Term: Second
Course Title	Plant Biotechnology Sessional		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The course is assigned to provide a practical demonstration to understand and exercise plant tissue culture and genetic engineering.		

	Course Contents/Tasks	CLOs
1	Laboratory organization.	1
2	Preparation of media.	2
3	Sterilization of media and instruments.	3
4	Explanation and establishment of in vitro cultures.	3, 5
5	DNA isolation, PCR analysis, and gel documentation.	4
6	Visiting established tissue culture laboratories of Bangladesh.	4, 5

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Design of an ideal micropropagation laboratory.	1, 2, 9, 12
	CLO2	Prepare tissue culture media and sterilize explant, instrument, and media.	2, 11, 12
	CLO3	Establish different micropropagation cultures with important crops.	2, 9, 11, 12
	CLO4	Isolate DNA, and conduct PCR base studies.	2, 3, 9, 12
	CLO5	Prepare gel documentation and analyze DNA profile.	2, 3, 9, 12

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO2	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO3	Lecture, demonstration, video clip, hands-on training, individual lab work, lab visit	Quiz, assignment, presentation, lab work assessment, viva voce
CLO4	Isolate DNA, and conduct PCR base studies	Quiz, assignment, presentation, lab work assessment, viva voce
CLO5	Prepare gel documentation and analyze DNA profile	Quiz, assignment, presentation, lab work assessment, viva voce

Learning Materials

Recommended Readings	Abbot, D. 2013. Recent Advances in Plant tissue culture and Biotechnology. Random Pub. India. Chawla, H.S. 2005. Introduction to Plant Biotechnology. 2nd ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. George, A. 2005. Understanding Biotechnology: An Integrated and Cyber-Based Approach. Pearson Education Ltd., India. Gupta, P.K. 1999. Cell and Molecular Biology. Rastogy Publishers, Meerut, India.
Supplementary Readings	Narayanswamy, S. 1999. Plant Cell and Tissue Culture. Tata McGraw-Hill Publishing Company Limited, New Delhi. Nicholl, D.S.T. 2013. An Introduction to Genetic Engineering. CUP, India. Rastogy, S.C. 2005. Cell Biology. New Age International Publishers, New Delhi. Razdan, M.K. 2008. An Introduction to Plant Tissue Culture. 2nd ed., Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi/Calcutta, India. Sadava, D.E. 1993. Cell Biology: Organells Structure and Function. Jones and Bartlett Publishers, Boston, London. Tong-Jen, F. 2009. Plant Cell and Tissue Culture for the Production of Food Ingredients. Springer, India.

Course Code: 0811 08 AT 4207		Year: Fourth	Term: Second
Course Title	Organizational Management and Diffusion of Innovation		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The graduates are intended to provide knowledge on principles and practices of extension organization, extension administration, extension educational system, social basis of human behavior, operation and feature of special segment of population, technology transfer process (diffusion of innovation) and AV aids in extension communication.		

	Course Contents	CLOs
	Section A	
1	Extension organization and administration: Meaning, main features, basic elements, principles and goals of an extension organization, the organizational structure of DAE, duties and responsibilities of different categories of personnel in DAE; meaning, basic principles and increasing efficiency in extension administration; principles of supervision and coordination in extension work; features and functions of office management (official correspondence- electronic and paper-based); types of records and documents, file indexing, human relations and human resource management, organizing and management of extension work in Bangladesh; problems of extension work in Bangladesh and their solution. Concepts of 4IR and 4AR in relation to extension services.	1, 2, 3, 4, 5
2	Extension educational system: Agricultural extension policy of Bangladesh (acts, policies and strategies); goals and objectives: short term and long term, strategies for implementing the goals and objectives; specific models of extension work in Bangladesh, India and other countries (similarities and dissimilarities). Internet and app-based extension services in Bangladesh.	5, 6
3	Human behavior: Process of socialization; Personality development, factors affecting personality development; frustration: causes and adjustment to frustration.	6
4	Rural youth, women and landless farmers: Rural youth-basic needs, youth service scheme and rural youth clubs; rural women-role of women in agriculture, employment opportunities for rural women, extension related to farm women; landless farmers- present status, employment opportunities, involvement in income-generating activities, empowerment in community development.	7, 8
	Section B	CLOs
5	Innovation and technology transfer: Meaning of diffusion, elements in the diffusion process, innovation-decision models, types of innovation and innovation decisions, attributes of innovations, adopter categories, consequences of innovations, obstacles in the innovation-decision process, factors affecting the transfer of technologies in agriculture.	9, 10
6	Planning of extension program: Meaning, importance, principles and steps of planning procedures of extension program; participation of people: concept, levels of participation, needs for people's participation in extension program, blocks to, advantages and limitations of people's participations; favorable and unfavorable conditions for program planning; reasons for failure of extension program.	11, 12
7	Monitoring and evaluation of extension program: Monitoring- definition, purpose, techniques, models and tools of monitoring; Evaluation- meaning, types, importance, objectives, principles, models and procedures of program evaluation.	13, 14
8	Audio-visual aids in extension communication: Meaning, classification, benefits and choice of audio-visual aids; non-projected and projected visual and audio-visual aids; criteria for selection and evaluation of audio-visual aids. Internet based aid and small-screen aid.	15

Course Learning Outcomes (CLOs)	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
	CLO1	Describe the extension organization-its features and principles, principles of supervision and coordination, feature and functions of office management.	11
	CLO2	Differentiate organizational structure of DAE and describe duties and responsibilities of personnel of DAE.	8, 11
	CLO3	Select different types of records and documents, the procedure of file indexing and maintain human relations.	9, 11
	CLO4	Identify the factors affecting the efficiency of extension administration and problems of extension work in Bangladesh and their solution.	11
	CLO5	Explain the extension policy and models of extension work in Bangladesh.	11
	CLO6	Describe the process of socialization; identify factors affecting personality development and causes and adjustment to frustration.	11
	CLO7	Describe rural youth, rural women and landless and their role in extension work.	11
	CLO8	Identify the schemes for involving rural youth and women.	11
	CLO9	Define and describe the diffusion process, adoption process and innovation decision model.	11
	CLO10	Describe elements of the diffusion process, types and attributes of innovation and adopter categories.	11
	CLO11	Identify factors affecting transfer of technology in agriculture.	1, 7
	CLO12	Plan extension program describing steps of the planning process and identifying reasons for failure of a program.	10
	CLO13	Interpret the meaning, types, importance, objectives, and principles of program monitoring and evaluation.	11
	CLO14	Select procedures of program evaluation.	11
	CLO15	Use, classify and choose AV aids for an extension activity.	11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Problem-based learning and presentation	Assignment and final exam
CLO3	Lecture and group discussion	Viva voce and final exam
CLO4	Lecture and team teaching	Quiz and class test
CLO5	Problem-based learning and presentation	Assignment and final exam
CLO6	Lecture and group discussion	Viva voce and final exam
CLO7	Lecture and team teaching	Quiz and class test
CLO8	Problem-based learning and presentation	Assignment and final exam
CLO9	Lecture and group discussion	Viva voce and final exam
CLO10	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation
CLO11	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation
CLO12	Lecturing, discussion, video presentation, demonstration, report writing	Assignment, quiz, presentation
CLO13	Lecture and team teaching	Quiz and class test
CLO14	Lecture and team teaching	Quiz and class test
CLO15	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam

Learning Materials

Recommended Readings	Alim, A. 1974. An Introduction to Bangladesh Agriculture. Swedish printing press, Dhaka. Bhuyian, M.A. 1988. Krishi Samprasaron Parichiti. Jamuna printers, Dhaka. Dahama, O.P. 1976. Extension and Rural Welfare. Ramprashad and sons, Agra, India. Kashem, M.A. 2006. Fundamentals of Agricultural Extension. Nilufar Kashem, Mymensingh. Kashem, M. A. 1992. Samprasaron Biggan (Extension Science). The Bangladesh Packing Press, Dhaka.
Supplementary Readings	Van den Ban, A. W. and Hawkins, H. S. 2002. Agricultural Extension. CBS Publishers & Distributors. Karthikeyan, C., Sendikumar, R. and Jaganathan, D. 2009. A Textbook of Agricultural Extension Management. New India Publishing Agency, New Delhi, India. Food and Agriculture Organization of the United Nations. 2019. Agricultural Extension Manual for Extension Workers. http://www.dae.gov.bd Kelsey, I. D. and Hearne, C. C. 1963. Co-operative extension work. Comstock Publishing Associates. Mergan, B., Holmes, G. E. and Bundy, C.L. 2012. Methods in Adult Education. Literary Licensing, LLC, USA. Ray, G. L. 2006. Extension Communication and Management. Joy Prakashani.

Course Code: 0811 08 AT 4208		Year: Fourth	Term: Second
Course Title	Extension Program planning and Outreach Program Sessional and Fieldwork		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	None		
Rationale	The graduates are intended to provide practical knowledge on extension program planning, preparation of annual plan and calendar of work, preparation of printed materials, conducting group discussion, seminar, workshop etc., planning training program and extension field trip.		

	Course Contents/Tasks	CLOs
1	Conduction of a survey of agricultural situation and prepare a short report.	1
2	Preparation of agricultural extension program for improvement of crop production.	1
3	Preparation of annual plan of work and calendar of work.	1
4	Group discussion techniques- seminar, symposium, conference, workshop, etc.	2
5	Public speaking techniques and practice.	2
6	Preparation of training program.	1, 2
7	Electronic correspondence and use of social media platforms.	1
8	Extension field trip to an agricultural farm, village and thana/upazila headquarters and preparation of the report.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Plan an extension program, training program and extension field trip design annual plan and calendar of work.	2
	CLO2	Demonstrate group discussion, seminar, conferences and workshop etc.	11
	CLO3	Describe duties and responsibilities of officers and personnel of thana/upazila head quarters.	9, 11

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Quiz and class test
CLO2	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam
CLO3	Lecturing, discussion, video presentation, demonstration, field and office visit, report writing	Assignment and final exam

Learning Materials

Recommended Readings	Alim, A. 1974. An Introduction to Bangladesh Agriculture. Swedish printing press, Dhaka. Bhuyian, M.A. 1988. Krishi Samprasaron Parichiti. Jamuna printers, Dhaka. Dahama, O.P. 1976. Extension and Rural Welfare. Ramprashad and sons, Agra, India. Kashem, M.A. 2006. Fundamentals of Agricultural Extension. Nilufar Kashem, Mymensingh. Kashem, M. A. 1992. Samprasaron Biggan (Extension Science). The Bangladesh Packing Press, Dhaka.
Supplementary Readings	Van den Ban, A. W. and Hawkins, H. S. 2002. Agricultural Extension. CBS Publishers & Distributors. Karthikeyan, C., Sendikumar, R. and Jaganathan, D. 2009. A Textbook of Agricultural Extension Management. New India Publishing Agency, New Delhi, India. Food and Agriculture Organization of the United Nations. 2019. Agricultural Extension Manual for Extension Workers. http://www.dae.gov.bd Kelsey, I. D. and Hearne, C. C. 1963. Co-operative extension work. Comstock Publishing Associates. Mergan, B., Holmes, G. E. and Bundy, C.L. 2012. Methods in Adult Education. Literary Licensing, LLC, USA. Ray, G. L. 2006. Extension Communication and Management. Joy Prakashani.

Course Code: 0811 08 AT 4209		Year: Fourth	Term: Second
Course Title	Economic Entomology and Pest Management		
Course Status	Core		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is focused to impart the updated knowledge on industrial insects, economics of pest control, host plant immunity, disease transmissionand management of major agronomic and horticultural pests to learners.		

	Course Contents	CLOs
	Section A	
1	Industrial Entomology: i) Concept, scope and importance of sericulture, apiculture and lac culture, social and economic problems associated with lower cultivation and production and their possible remedies, important strains/species of honey bees, silkworms and lac insects. ii) Care and maintenance of apiary, inoculation and rearing of honey bee, silkworm and lac insects, biotic and abiotic stresses of honey bee, silkworm and lac insects and possible means to improve those, collection and processing of honey, wax, silk and shellac.	1
2	Pest Management: Concept of pest, pest types and economics of pest control– injury, damage, economic threshold level, economic injury level, action threshold and their usefulness in agriculture, pest control strategies – principles, approaches (prevention, protection and eradication) and methods (cultural, mechanical, physical, biological, bio-rational, semio-chemical, genetic and chemical) of insect pest management with their components' relative benefits and loopholes, elementary knowledge to IPM.	2
3	Pest Monitoring and Forecasting: Fundamentals, detailed methods of surveillance, forecasting and warning, their necessity and usefulness in crop protection, implications of different mathematical models in pest forecasting with relative merits and demerits.	2
4	Agronomic Pests: Ecology, biology, nature of damage and chemical and non-chemical management of major pests of field crops – cereal (rice, wheat, maize) fiber crops (cotton & jute), pulses (lentil, mungbean, pea, chickpea), sugarcane, oil crops (sesame, mustard, sunflower) widely grown in Bangladesh and pests of stored products (rice, pulses, flour, wood, papers and clothes).	2
	Section B	CLOs
5	Disease Transmission: Elemental knowledge of insect-borne plant pathogens and their vectors, relationship between diseases and vector insects, types and mechanisms of insect borne diseases transmission in plants, ecology, evolution, and complex interactions of plant pathogens and their vectors, significance of diseases transmission in agriculture.	3, 2
6	Host Plant Defense: Theory, constitutive and induced resistance to pest, antibiotic and antixenosis responses of hosts to pest infestation, systemic acquired resistance (SAR) and induced systemic resistance (ISR), molecular aspects of host plant resistance, Flor's gene-for-gene model of pest resistance, economic importance in crop protection.	4
7	Pesticides: Concept, developmental history, classification, formulation, mode of action, factors affecting efficacy of pesticide, drifting, pesticide spray types, spay droplet size, LD50, LC50 and LT50, pesticide safety, ways to remove pesticide residues from vegetable and fruits, pesticide persistence, behavioral resistance, pesticide resistance (horizontal & vertical), its development and remedies, pest resurgence and Secondary outbreak, effects of pesticides in environment.	5
8	Horticultural Pests: Biology, ecology, nature of damage and chemical and non-chemical control measures of major insect and mite pests of vegetables, flowers, ornamentals and fruits crops commonly grown in Bangladesh.	2
9	Vertebrate Pests: Types, biology, damage and control measures of vertebrate pests giving emphasis to the rodents of field crops and in storage.	2

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Evaluate the industrial importance of sericulture, apiculture and lac culture as well as improve their rearing and disease management techniques	1, 4, 7, 9
	CLO2	Monitor, forecast, and warn pest incidence by incorporating different mathematical models and thereby prescribe judicious management strategies for agronomic, horticultural pests and rodents via estimating the economics of pest controlinvolving economic threshold and injury level.	1, 4, 6, 7, 9
	CLO3	Solve the insect-vectored disease problems in cropsby analyzing their ecology, evolution, and complex interactions of plant pathogens and designing appropriate IPM against the pest-pathogen duo.	1, 4, 6, 7
	CLO4	Interpret host plant immunity with characterization of constitutive and induced resistance to pest and pathogens as well as analyze systemic acquired resistance (SAR) and induced systemic resistance (ISR) on molecular pointsas per Flor's gene-for-gene theory.	1, 7, 9
	CLO5	Prepare insecticide formulation and explain the development mechanisms of pesticideresistance in insects and its remedies alongside the identification of factors influencing the efficiency of insecticide application in field condition.	1, 2, 6, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, brain storming and problem solving	Quiz, class test and final exam
CLO2	Lecture, group discussion, brain storming and problem solving	Presentation, quiz, assignment and final exam
CLO3	Lecture, group discussion, brain storming and problem solving	Class test, viva voce and final exam
CLO4	Lecture, group discussion, brain storming and problem solving	Quiz, assignment, class test and final exam
CLO5	Lecture, group discussion, brain storming and problem solving	Presentation, quiz, class test and final exam

Learning Materials

Recommended Readings	Butter, N.S. 2018. Insect Vectors and Plant Pathogens. Routledge, Taylor and Francis, New York, United States. Dent, D.R. 2020. Insect Pest Management. 3rd ed., CABI, Wallingford, Oxfordshire, England. Abrol, D.P. 2013. Integrated Pest Management: Current Concepts and Ecological Perspective. Academic Press, Cambridge, Massachusetts, USA. Khan, M.A. and Ahmad, W. 2019. Microbes for Sustainable Insect Pest Management: An Eco-friendly Approach - Volume 1. Springer, Netherlands. Dyck, V.A., Hendrichs, J. and Robinson, A.S. 2021. Sterile Insect Technique: Principles and Practice in Area-Wide Integrated Pest Management. CRC Press, Routledge, Taylor and Francis, New York, United States.

Supplementary Readings	https://genent.cals.ncsu.edu/bug-bytes What is Biological Control? (cornell.edu) Biological Control of Insect Pest | IntechOpen Plant Resistance To Insects (agriculturistmusa.com) Pests & Diseases | Plantix Biological Pest Control - Definition, Types and Examples (vedantu.com) Method/Techniques in Biological Control (imp. center) Mycorrhizal Fungi Powder | Trusted Manufacturer and Global Exporter (indogulfbioag.com) https://organicwayfarming.com/pest-and-disease Chakravarthy, A.K. 2015. New Horizons in Insect Science: Towards Sustainable Pest Management. Springer, Netherlands. Vishwakarma, R. 2020. Management of Insect Pests in Vegetable Crops. Apple Academic Press, Palm Bay, FL, United States. Omkar, G. 2016. Ecofriendly Pest Management for Food Security. Academic Press, Cambridge, Massachusetts, USA. Abrol, D.P. and Shankar, U. 2016. Integrated pest management: principles and practice. CAB International, Nosworthy Way, Wallingford, UK. Omka, G. 2017. Industrial Entomology. Academic Press, Cambridge, Massachusetts, USA. Vasantharaj, D.B. and Romomurthy, V.V. 2016. Elements of Economic Entomology. 8th ed., Brillion Publishing, New Delhi, India. Hoffmann, K.H. 2015. Insect Molecular Biology and Ecology. Routledge, Taylor and Francis, New York, United States. Gilbert, L.I. 2011. Insect Molecular Biology and Biochemistry. Academic Press, Cambridge, Massachusetts, USA. Hoy, M. 2018. Insect Molecular Genetics: An Introduction to Principles and Applications, 4th ed., Elsevier, Amsterdam, Netherlands. Kumar, D. and Gong, C. 2018. Trends in Insect Molecular Biology and Biotechnology. Elsevier, Amsterdam, Netherlands.

Course Code: 0811 08 AT 4210	Year: Fourth	Term: Second
Course Title	Economic Entomology and Pest Management Sessional and Fieldwork	
Course Status	Core	
Credit	1.0	
Prerequisite(s)	None	
Rationale	The course is aimed atproviding hands-on experience on industrial insect management, insecticide handling and calibration, and identification and management of major agronomic and horticultural pests.	

	Course Contents/Tasks	CLOs
1	Construction and maintenance of apiary and extraction of honey.	1
2	Demonstration of rearing techniques of silkworms and lac insects and their processing into silk and shellac along with cultivation and maintenance of their host plants viz. mulberry plants, fig, ber, acacia.	1
3	Operation, maintenance and safety measures of using plant protection appliances.	2
4	Preparation, precautions and calibration of insecticide formulations and their doses under specific field conditions for controlling insects, mites and rodents.	2
5	Surveillance of major pests of cereal, fiber, oil, pulse, vegetables, flowers, fruits and stored grains alongsidethe preparation of a report focusing on the nature of the damage and suggestingjudicious control measures.	3
6	Design and optimize integrated pest management (IPM) program for managing agricultural pests.	4
7	Field trips.	1, 2, 3, 4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Establish apiary, lac-culture and sericulturewith proper management of their pest and diseases.	1, 4, 9
	CLO2	Prepare, calibrate and apply pesticides of different formulations to control the pests.	1, 4, 7, 9
	CLO3	Forecast the pest prevalence by surveying the field following proper surveillance technique.	1, 4, 9
	CLO4	Prescribe judicious integrated pest management (IPM) of agronomic, horticultural and stored pests.	1, 4, 7, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO2	Lecture, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO3	Lecture, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final
CLO4	Lecture, group discussion, brain storming and problem solving	Quiz, evaluation of laboratory and fieldworks and sessional final

Learning Materials

Recommended Readings	Butter, N.S. 2018. Insect Vectors and Plant Pathogens. Routledge, Taylor and Francis, New York, United States. Dent, D.R. 2020. Insect Pest Management. 3rd ed., CABI, Wallingford, Oxfordshire, England. Abrol, D.P. 2013. Integrated Pest Management: Current Concepts and Ecological Perspective. Academic Press, Cambridge, Massachusetts, USA. Khan, M.A. and Ahmad, W. 2019. Microbes for Sustainable Insect Pest Management: An Eco-friendly Approach - Volume 1. Springer, Netherlands. Dyck, V.A., Hendrichs, J. and Robinson, A.S. 2021. Sterile Insect Technique: Principles and Practice in Area-Wide Integrated Pest Management. CRC Press, Routledge, Taylor and Francis, New York, United States.
Supplementary Readings	https://genent.cals.ncsu.edu/bug-bytes What is Biological Control? (cornell.edu) Biological Control of Insect Pest | IntechOpen Plant Resistance To Insects (agriculturistmusa.com) Pests & Diseases | Plantix Biological Pest Control - Definition, Types and Examples (vedantu.com) Method/Techniques in Biological Control (imp. center) Mycorrhizal Fungi Powder | Trusted Manufacturer and Global Exporter (indogulfbioag.com) https://organicwayfarming.com/pest-and-disease Chakravarthy, A.K. 2015. New Horizons in Insect Science: Towards Sustainable Pest Management. Springer, Netherlands. Vishwakarma, R. 2020. Management of Insect Pests in Vegetable Crops. Apple Academic Press, Palm Bay, FL, United States. Omkar, G. 2016. Ecofriendly Pest Management for Food Security. Academic Press, Cambridge, Massachusetts, USA. Abrol, D.P. and Shankar, U. 2016. Integrated pest management: principles and practice. CAB International, Nosworthy Way, Wallingford, UK. Omka, G. 2017. Industrial Entomology. Academic Press, Cambridge, Massachusetts, USA. Vasantharaj, D.B. and Romomurthy, V.V. 2016. Elements of Economic Entomology. 8th ed., Brillion Publishing, New Delhi, India. Hoffmann, K.H. 2015. Insect Molecular Biology and Ecology. Routledge, Taylor and Francis, New York, United States. Gilbert, L.I. 2011. Insect Molecular Biology and Biochemistry. Academic Press, Cambridge, Massachusetts, USA. Hoy, M. 2018. Insect Molecular Genetics: An Introduction to Principles and Applications, 4th ed., Elsevier, Amsterdam, Netherlands. Kumar, D. and Gong, C. 2018. Trends in Insect Molecular Biology and Biotechnology. Elsevier, Amsterdam, Netherlands.

Course Code: 0721 08 AT 4251		Year: Fourth	Term: Second
Course Title	Post Harvest Technology		
Course Status	Optional		
Credit	3.0		
Prerequisite(s)	None		
Rationale	The course is designed to disseminate knowledge on postharvest technology of agronomic and horticultural crops to capacitate the students in postharvest handling of these crops.		
Objective	To enrich students' knowledge on postharvest management of agronomic and horticultural crops.		

	Course Contents	CLOs
	Section A	
1	Seed drying: Concept, advantages, methods of seed drying; equilibrium moisture content and its determination; grain drying systems; forced air drying methods; seed dryers with their advantages and disadvantages.	1
2	Seed cleaning: Principles and methods of seed cleaning.	1
3	Parboiling of paddy: Concept, advantages, processing variables in parboiling; physio-chemical changes during parboiling; effects of parboiling on milling, nutritional and cooking qualities of rice; parboiling methods.	2
4	Milling and grinding: Concept; factors influencing milling breakage; influence of milling on composition and quality of rice grain; methods of husking, factors affecting the effectiveness of husking; grinding of cereals.	2
5	Storage: Factors influencing storage; principles of seed storage; different grain storage systems and storage structures.	3
	Section B	CLOs
6	Post harvest handling of horticultural crops: Maturity and stage of harvest; principles and methods of harvesting, grading, packing, transportation and marketing of horticultural crops.	4
7	Storage of horticultural crops: Methods of storage; physiology of stored crops in fresh condition; factors affecting the physiological processes of stored crops in fresh condition.	5
8	Post-harvest losses: Assessment of quantitative, qualitative and nutritional losses; factors influencing post-harvest losses; causes and control of post-harvest losses.	4
9	Processing and preservation of horticultural crops: Importance, principles and methods of processing and preservation.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Explain seed cleaning and seed drying in detail.	1, 2, 3, 5, 9
	CLO2	Justify parboiling, milling and grinding of paddy (rice).	1, 2, 3, 5, 9, 10
	CLO3	Suggest suitable method of seed storage.	1, 2, 3, 5, 9, 10
	CLO4	Discuss the post-harvest handling, storage, processing and preservation of horticultural crops.	1, 2, 3, 5, 9
	CLO5	Assess the post-harvest loss of horticultural crops and its remedies.	3, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecturing, video demonstration, assignment, group discussion	Formative (Objectives, quiz, short questions,) and summative
CLO2	Lecturing, presentation, field tour, assignment, group discussion	Formative (Objectives, quiz, short questions, presentation) and summative
CLO3	Lecturing, presentation, field tour, assignment, group discussion	Formative (Objectives, quiz, short questions, MCQ, presentation) and summative
CLO4	Lecturing, group discussion, assignment	Formative (Objectives, quiz, short questions, MCQ, presentation) and summative
CLO5	Lecturing, video demonstration, presentation, field visit, assignment, group discussion	Formative (Viva, quiz, short questions, MCQ, presentation) and summative

Learning Materials

Recommended Readings	Agrawal, P.K. and Dadlani, M. 1992. Techniques in Seed Science and Technology. South Asian Publishers Pvt. Ltd. New Delhi. Agrawal, R. L. 1995. Seed Technology Oxford & IBH Pub. Co. Pvt. Ltd. Dew Delhi. Bala, B. K. 1997. Drying and Storage of Cereal Grains. Oxford & IBH Pub. Co. Pvt. Ltd. Dew Delhi. Bangladesh Agricultural Research Council (BARC). 1992. Training manual on postharvest handling and marketing.
Supplementary Readings	Bose, T.K. and Mitra, S.K. 1990. Fruits: Tropical and Subtropical. Naya Prokash, Calcutta, India. Chakraverty A. 1995. Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Kader, A.A. 2002. Postharvest Technology of Horticultural Crops. University of California Agriculture and Natural Resources. USA. Pillaiyas, P. 1988. Rice Postproduction Manual. Wiley Eastern Ltd., New Delhi. Wills, R.B.H., Lee, T.H., Grahan, D., Glasson, W.B.M. and Hall, E.G. 1981. Postharvest, an introduction to the physiology and handling of fruit and vegetables. AVI Publishing Co. Inc. Westport, Conn.

Course Code: 0721 08 AT 4252		Year: Fourth	Term: Second
Course Title	Post Harvest Technology Sessional and Fieldwork		
Course Status	Optional		
Credit	1.0		
Prerequisite(s)	None		
Rationale	This course includes postharvest perspectives of agronomic and horticultural crops to build students' practical knowledge and skills on postharvest technology of these crops.		
Objective	To increase students' knowledge on management practices for agronomic and horticultural crops during postharvest handling and processing for better storage.		

	Course Contents/Tasks	CLOs
1	Observation of parboiling of rice.	1
2	Observation of milling and milling quality of rice.	1
3	Study on seed storage practices.	2
4	Study of postharvest techniques for controlling quality deterioration of harvested crops.	2, 3
5	Study on controlling diseases in harvested crops by handling practices.	2, 3
6	Postharvest handling system of fruits vegetables and flowers.	3

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Demonstrate parboiling, milling and storage of cereals.	1, 2, 3, 9
	CLO2	Practice postharvest techniques to control quality deterioration and disease infestation in harvested crops.	2, 3, 4, 5, 9
	CLO3	Exercise postharvest handling systems for fruits vegetables and flowers.	3, 4, 5, 9

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, video demonstration and group discussion	Formative (Quiz, performance evaluation, active class participation) and summative
CLO2	Lecture, video demonstration and discussion	Formative (Quiz, assignment, objectives, active class participation) and summative
CLO3	Lecturing, demonstrationfield visit and discussion	Formative (Objectives, quiz, question-answering, presentation) and summative

Learning Materials

Recommended Readings	Agrawal, P.K. and Dadlani, M. 1992. Techniques in Seed Science and Technology. South Asian Publishers Pvt. Ltd. New Delhi. Agrawal, R. L. 1995. Seed Technology Oxford & IBH Pub. Co. Pvt. Ltd. Dew Delhi. Bala, B. K. 1997. Drying and Storage of Cereal Grains. Oxford & IBH Pub. Co. Pvt. Ltd. Dew Delhi. Bangladesh Agricultural Research Council (BARC). 1992. Training manual on postharvest handling and marketing. Bose, T.K. and Mitra, S.K. 1990. Fruits: Tropical and Subtropical. Naya Prokash, Calcutta, India.
Supplementary Readings	Chakraverty A. 1995. Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH Pub. Co. Pvt. Ltd. New Delhi. Kader, A.A. 2002. Postharvest Technology of Horticultural Crops. University of California Agriculture and Natural Resources. USA. Pillaiyas, P. 1988. Rice Postproduction Manual. Wiley Eastern Ltd., New Delhi. Wills, R.B.H., Lee, T.H., Grahan, D., Glasson, W.B.M. and Hall, E.G. 1981. Postharvest, an introduction to the physiology and handling of fruit and vegetables. AVI Publishing Co. Inc. Westport, Conn.

Course Code: 0118 08 AT 4214		Year: Fourth	Term: Second
Course Title	Central Viva Voce		
Course Status	Core		
Credit	1.0		
Prerequisite(s)	All offered courses		
Rationale	A grand Viva Voce or oral exam is an important learning practice in education in which questions are asked to the student in verbal form and the student has to answer the questions to demonstrate sufficient knowledge of the subject matter.		
Objective	To face Viva Voce confidently and answer the questions accurately.		

	Course Contents/Tasks	CLOs
1	All course teachers will conduct the viva and assess the students.	1
2	All course teachers will test the depth of basic knowledge regarding the relevant subjects learnt so far.	2
3	Questions will be asked on personal views on various issues relevant to agricultural science and its contemporary issues.	3
4	All course teachers will exchange views on professional etiquette suitable for career progression.	4

	Upon successful completion of the course, the students will be able to:		Mapping with PLOs
Course Learning Outcomes (CLOs)	CLO1	Demonstrate basic level of understanding on relevant subjects learnt so far.	1
	CLO2	Demonstrate self-confidence in facing a jury board for oral examination in general.	6
	CLO3	Present his/her views convincingly and precisely.	9, 10
	CLO4	Exhibit professional etiquette suitable for career progression	2, 7

Mapping CLOs with the Teaching-Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture and team teaching	Viva voce and final exam
CLO2	Lecture and group discussion	Viva voce and final exam
CLO3	Lecture and team teaching	Viva voce and final exam
CLO4	Lecture and group discussion	Viva voce and final exam

Learning Materials

Recommended Readings	All the previously taught courses
Supplementary Readings	Relevant other books/ study materials would be provided by the Course Instructor during the teaching period.

20 Grading and Evaluation

20.1 Grading Scale

a) Letter Grades and corresponding Grade Points will be awarded following provisions shown below:

Numerical Grade	Letter Grade	Grade Point
80% or above	A+ (A plus)	4.00
75 to less than 80%	A (A regular)	3.75
70 to less than 75%	A- (A minus)	3.50
65 to less than 70%	B+ (B plus)	3.25
60 to less than 65%	B (B regular)	3.00
55 to less than 60%	B- (B minus)	2.75
50 to less than 55%	C+ (C plus)	2.50
45 to less than 50%	C (regular)	2.25
40 to less than 45%	D	2.00
Less than 40%	F	00
Incomplete	I	
Withdrawn	W	
Continuation (for the project, thesis design, etc. course)	X	

20.1.1 Evaluation of Theory Courses

a) All theory courses will be evaluated out of 100 marks, the distribution of which is given below:

Sl. No.	Items	Marks
1	Attendance and Class Participation	10
2	Continuous Assessments	30
3	Term Final Examination	60
	Total	100

b) The basis for awarding marks for class attendance and participation will be as follows:

Attendance & Participation	Marks
90% or above	10
85 to below 90%	9
80 to below 85%	8
75 to below 80%	7
70 to below 75%	6
65 to below 70%	5
60 to below 65%	4
Below 60%	0

c) The continuous assessments of the theory courses may be conducted in the form of class tests, assignments, homework, presentation, quiz, viva voce, etc. The course teacher(s) will evaluate every continuous assessment and share the result with the students within 2(two) weeks of conducting that continuous assessment.

d) The duration of a class test may be 20-45 minutes, and it will preferably be given during class hours.

e) If a student does not attend the class test for reasons satisfactory enough to the course teacher, the course teacher may allow the student one more chance for such assessment during the term; however, it must be held before the term final examinations. A student who has been absent for a short period, up to a maximum of three weeks due to illness, should approach the course teacher(s) or Coordinator(s) for make-up of quizzes/class tests or assignments, etc.,

immediately on returning to the classes. Such request should be supported by a medical certificate endorsed by the Chief Medical Officer of the University. The medical certificate issued by a registered medical practitioner (with the registration number shown explicitly on the certificate) and endorsed by the Chief Medical Officer of the University will also be acceptable only when the student has valid reasons for his/her absence from the University.

f) The number of Continuous Assessments (CAs) in each course will be as follows:

No. of credit(s)	Total no. of CA required	CAs to be considered for grading
3 – 4	4 (2 in each section)	Section best assessments shall be averaged for grading
1.5 – 2	3 (at least one in each section)	

g) If two teachers teach a course, both the teachers will conduct continuous assessments individually.

h) Answer scripts of the continuous assessment may be shown to the students to identify their strengths and weaknesses, but those would not be returned to them. The concerned teacher would submit the evaluated continuous assessment answer scripts and attendance register to the Head of the Discipline/Program Offering Entity (POE). The final score of attendance and class participation (out of 10) and continuous assessment (out of 30) should be displayed on the Discipline's notice board/ Discipline website/ Course web page before starting the term final examination.

i) The course teachers must submit the continuous assessment mark sheets to the Chair of the Examination Committee before the starting of the term final examination.

j) The Term Final Examination will carry 60 marks. There will be two separate answer scripts for Section A and Section B in the Term Final Examination.

k) When a student repeats a course in which he/she previously obtained an F grade, he/she will be given just an immediate lower grade that he/she obtained in the repeated course. However, in case he/she obtains a D grade, that will be maintained, and this grade will be shown in the transcript. If a student has to repeat a course due to punishment on him/her, the grade obtained will be maintained. If a student obtains a grade other than an F in a course, he/she will not be allowed to repeat the course for grade improvement.

l) If a student obtains an 'F' grade in any Core course in any term, this 'F' grade will not be counted for Grade Point Average (GPA) but will be shown on the grade sheet, and in such case, he/she will have to retake the course for grade improvement.

m) While registering for a retake/re-retake theoretical course, a student must be given an option to decide whether s/he intends to sit for continuous assessment of the course. If s/he opts to sit for continuous assessments, his/her fresh mark will be counted to prepare the result. However, the class attendance and participation marks will be taken from the previous record.

n) A student has to register for the backlog/retake/re-retake core courses first followed by the fresh courses offered by the Discipline for the term s/he is going to enrol subject to the compliance with: (i) completion of prerequisite courses (if any) and (ii) maximum registration limit of 25 credits per term. However, s/he may not choose to register the optional backlog/retake/re-retake courses first.

o) In addition, a student may be allowed to register for advance course(s) in a term subject to: (i) his/her all backlog/retake/re-retake and offered core courses are either clear or registered, (ii) his/her current terms' offered all core courses are registered, (iii) completion of corresponding prerequisite courses (if any), (iv) compliance with a maximum registration limit of 25 credits per term, and (v) the desired advance courses are offered by the Discipline/POE in the current term. However, such advance course registration option will not be applicable for capstone courses like Thesis/Project/ Internship/ Research study/ Monograph/ Portfolio, and so on.

p) A Special Term may be offered for the final year students who have retake/re-retake course(s). In this case, the maximum credit limit for a student will be 15 credits. This will be a Non-Taught Term. The Examination of Special Term will start 4 (four) weeks after publishing 4th-year 2nd Term results and will continue not more than 2 (two) weeks. The continuous assessment marks (40%) will be carried over from previously registered theory course(s), and Special Term Final Examination will carry the remaining (60%) marks. Final Year Term Thesis/Dissertation/Design or Core Sessional(s) supervisor(s)/course teacher(s) in consultation with the Head may allow the student(s) to re-submit the Thesis/

Dissertation Design or Core Sessional(s) within the Special Term schedule. However, it must be within the allowed limits of the Special Term credits.

20.1.2 Evaluation of Sessional Courses

a) All sessional courses will be evaluated out of 100 marks, the distribution of which is given below:

Sl. No.	Items	Marks
1	Attendance/Class Participation/Contact with teachers	10
2	Sessional Evaluation/Internal criticism/Observation	60
3	Viva Voce/ Final Jury	30
	Total	100

b) Sessional evaluation would be done through a laboratory test, class test, quiz, assignment, assigned project, report, oral test, performance/behaviour of the students, etc. The course teacher(s) will complete every sessional evaluation and share the result with the students within 2(two) weeks of conducting that item. Attendance and sessional evaluation mark sheets (out of 10+60=70) will be displayed on the Discipline's notice board/Discipline website/Course web page before starting the term final examination.

c) Viva Voce of each sessional course will usually be conducted by the course teacher(s). The senior most among the course teachers (if any) will be the Chair of the viva board. However, such viva voce/final assessment of a sessional course can also be done through jury board in applicable cases. The jury board will be headed by the Head of the Discipline or any other senior teacher of the Discipline/POE not below the rank of Assistant Professor. The Chairman of the viva/jury board may appoint other teacher(s) as a board member if necessary. A student must attend a sessional evaluation and viva voce. In case of absence in any component, he/she will get an F grade in that course.

d) The course teachers must submit the continuous assessment mark sheets to the Chair of the Examination Committee before the starting of the term final examination.

e) A student may register sessional courses as retake/re-retake (if applicable) on the Discipline Head's written approval. For retake/re-retake sessional courses, no previous records/marks will be counted.

20.1.3 Evaluation of Capstone Courses

a) The distribution of marks for a Capstone (Thesis/ Monograph/ project paper/ etc.) course will be as follows:

Sl. No.	Description	Marks
1	Contact/Discussion/Communication with the Supervisor	10
2	Evaluation	60
3	Oral presentation and/or Viva voce	30
	Total	100

b) There will be two examiners (including the Supervisor) to examine the Thesis. Each examiner will evaluate the Thesis separately, and the average marks will be considered for grading. However, if the marks given by the First and Second Examiners vary 20% or more, a Third Examiner to be appointed by the concerned Examination Committee from the outside the University will evaluate the Thesis Monograph/Project paper. Among these numbers, the average of the closest two numbers will be considered for grading. However, if the marks given by the Third Examiner happen to stand at the middle of the marks given by the first two Examiners, the average of the three marks will be considered for grading.

c) For the thesis/dissertation/final project/other projects like the thesis of the final year students, there will be a presentation and defense session before the defense board. If deemed necessary to the concerned defense board, these sessions might be arranged online. A three-member defense board will evaluate the presentation and defense session. The Supervisor of the thesis/ project/ internship/ research study/ monograph/ portfolio courses will normally be the Chairman of the board while the Second examiner and one member nominated by the Head of the Discipline/POE will be the members of the defense board. Every member of the defense board will evaluate individually and the final marks will be calculated by averaging all the marks given by the three members. The defense board members will be remunerated individually as per the approved rate of the university. For Jury board or in other special circumstances, the Head of the Discipline/POE might include additional member(s) in the board for justifiable reasons.

d) A Discipline might allow some students to register for an Internship program/ Project paper/ Monograph/ Research study according to the course curriculum of the respective Discipline. Such an internship program/ Project paper/Research study course might be considered as the substitute of Thesis for those students. The evaluation and related activities of such Internship program/ Project paper/ Research study courses will be similar to Thesis. Usually, a Thesis will carry double weight in terms of credit compared to other alternatives like Project/ Internship/ Research study/ Monograph/ Portfolio and so on.

e) A Discipline might allow splitting the thesis/similar course into more than one term. 'X' grade may be assigned for continuing the same course in multiple terms to assign a complete grade in the last term. Alternatively, multiple courses under thesis/similar course might be assessed by providing complete grades at the end of each term. The curriculum of the concerned Discipline/Entity will clarify all such issues.

20.1.4 Evaluation of Viva Voce

a) There might be a grand viva voce in each term. A student will not usually be allowed to register for more than one course of this type bearing 01 (one) credit in a term. The concerned Examination Committee of that Term will conduct the viva and assess the students. The distribution of marks for viva voce will be as follows:

Description	Marks
Viva voce	100

20.2 Grades

Grade related issues are reported in section 20.1.

20.3 Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

a) Grade Point Average (GPA) is the weighted average of Grade Points obtained in all the courses passed/completed by a student. For example, if a student has passed/completed five courses in a term having credits of C1, C2, C3, C4, and C5 and his/her points in these courses are G1, G2, G3, G4, and G5, respectively, then,

$GPA = \sum CiGi/\sum Ci$

b) A Numerical Example: Suppose a student has completed five courses in a term and obtained the following grades:

Course	Credit	Grade	Grade Point
A	3	A+	4.00
B	3	C+	3.00
C	3	A	3.75
D	2	B	3.25
E	1	B+	3.50

Then his/her GPA for the term will be computed as follows:
GPA= 3(4.0) + 3(3.0) + 3(3.75) + 2(3.25) + 1(3.5) /(3 + 3 + 3 + 2 + 1) = 3.52

c) A student's performance will be evaluated in terms of three indices- Term Grade Point Average (TGPA), Yearly Grade Point Average (YGPA), and Cumulative Grade Point Average (CGPA). The TGPA is computed by dividing the total points earned in a Term by the number of credits taken in the Term. The YGPA is computed by dividing the total grade points earned in two Terms in a year by dividing the number of credits taken in that year. The CGPA is computed by dividing the total grade points accumulated till date by the total completed credits. Thus a student who has earned 275 grad points in attempting 100 credits of courses would have an overall CGPA of 2.75.

20.4 Course Withdrawal

a) 'W' is the corresponding grade for withdrawn of a course, as mentioned in section 20.1.

b) If any student cannot complete the Term Final Examination due to severe illness or serious accident, he/she may apply to the Dean through the Head of the concerned Discipline for total withdrawal from the Term within eight working days after the Term Final Examination. However, he/she may choose not to withdraw from any sessional course if the grade obtained in such a course is C or better. A medical certificate endorsed by the Chief Medical Officer of the University must support the application. The Dean of the concerned School will decide on such an application and inform the Academic Council. If a student is allowed to withdraw from a Term, he/she will have to register as fresh from the Term he/she has withdrawn. However, he/she may be allowed to register for backlog courses, if offered.

20.5 Incomplete (I) Courses

'I' is the corresponding grade for an incomplete course, as mentioned in section 20.1.

20.6 Retake

Retake related issues are reported in sections 20.1.1 and 20.1.2.

20.7 Grade Improvement

Grade improvement related issues are reported in section 20.1.1.

20.8 Dropout/Cancellation of Studentship

a) A first-year first term student's admission will stand cancelled if he/she fails to complete course registration by ten working days from the beginning of the classes.

b) A first-year first term student's admission will stand cancelled if he/she fails to attend at least 50 percent of classes during ten working days from the beginning of the classes. However, in case of severe illness/accident this provision may be relaxed subject to submission of a medical certificate issued by a registered medical practitioner (with the registration number shown explicitly on the certificate) and endorsed by the Chief Medical Officer of the University.

c) A student's studentship will stand cancelled if he/she fails to comply with registration of minimum credit requirements under article 12.2 of the latest (July 2022) 'Ordinance for Undergraduate Program' of Khulna University. According to that article, a student must register for at least 15 credits per term and may be allowed to register for up to a maximum of 25 credits if recommended by his/her Discipline Head. The Discipline/POE might offer less than, greater than or equal to 25 credits per term as per the approved curriculum. The student will enjoy the option of choosing backlog, re-take, re-retake, advance courses (subject to compliance with applicable requirements/restrictions, as reported in other articles of the Ordinance) in addition to fresh courses to comply with the restriction of maximum 25 credits per term. If any student fails to register, in any way, for minimum credits (15 credits), his/her studentship at the University will stand cancelled. This minimum 15-credit registration limit may be relaxed if: (i) the student requires less than 15-credit to complete his/her graduation, or (ii) the sum of applicable (for the student) credits offered by the Discipline is less than 15-credit in the corresponding term for any valid reason.

d) A student's studentship will stand cancelled if he/she fails to earn minimum credits under article 12.5.2 of the latest (July 2022) 'Ordinance for Undergraduate Program' of Khulna University. According to that article, when a student is going to register for his/her courses in the 3rd year 2nd term, his/her earned credits up to 2nd year 2nd term must be at least 36. Otherwise, his/her studentship at the University will stand cancelled.

Approval Records	
Approving Authority	Date of Approval
Curriculum Committee of the Discipline	August 29, 2022
Executive Committee of the School	Spetember 11, 2022
BOAS (if applicable)	
Academic Council	October 12, 2022
Syndicate (if applicable)	October 20, 2022

Appendix 01: Summary of Major Changes in the OBE Format Curriculum

Program : Bachelor of Science in Agriculture (Honours)
Discipline : Agrotechnology
School : Life Science School

Sl. No.	Criteria	Existing Curriculum	OBE Curriculum
1	Duration of the Program (in Year)	4	4
2	Total Available Credits	187	214
3	Minimum Credit Requirement to Complete the Degree	160	161
4	Available Credits from GED Courses	27	57
5	Credits from GED Courses (% of Total Credits)	14.43	26.64%
6	Credits from GED Courses (% of Required Credits)	10%	25%
7	Available Credits from Core Theory Courses*	93	94
8	Available Credits from Core Sessional Courses*	36	32
9	Available Credits from Optional Theory Courses*	22	15
10	Available Credits from Optional Sessional Courses*	6	4
11	Available Credits from Capstone Courses	3	12
12	Term Duration (in week)	22	22
13	Credits from Newly Introduced Courses	-	15
14	Number of Newly Introduced Courses	-	8
15	Number of Omitted Courses	-	-
16	Change in Course Title (Number of Courses)	-	1
17	Change in Course Status (Number of Courses)	-	-
18	Inter-term Shift (Number of Courses)	-	-
19	Change in Course Contents (Number of Courses)	-	3
20	Name of Majors (if Applicable)	-	-
21	Name of Modes (if applicable)	Thesis	Thesis/Project/Internship

*including GED courses

Appendix 02: Concerned Committee of the Discipline/POE

Sl. No.	Name and Address	Designation in Committee
01	Prof. Dr. Shamim Ahmed Kamal Uddin Khan Head, Agrotechnology Discipline	Chairman of the Curriculum Committee
02	Professor Dr. Md. Mozahar Ali Retired Professor, GTI, BAU, Mymensingh Contractual Professor, Dept. of Agriculture, BSMRSTU, Gopalganj	Expert Member
03	Professor Dr. Md. Shahidul Islam Dept. of Plant Pathology, PSTU, Patuakhali Director, IQAC, PSTU, Patuakhali	Expert Member
04	Professor Dr. Md. Yasin Ali Agrotechnology Discipline	Member
05	Professor Khan Golam Quddus Dean, Life Science School	Member
06	Prof. Dr. Mohammad Bashir Ahmed Agrotechnology Discipline	Member
07	Professor Dr. Md. Monirul Islam Agrotechnology Discipline	Member
08	Professor Dr. Sarder Safiqul Islam Agrotechnology Discipline	Member
09	Professor Dr. Md. Sarwar Jahan Agrotechnology Discipline	Member
10	Professor Md. Rejaul Islam Agrotechnology Discipline	Member
11	Professor Dr. Md. Abdul Mannan Agrotechnology Discipline	Member
12	Prof. Dr. Md. Shafiqul Islam Agrotechnology Discipline	Member
13	Professor Dr. Mahtalat Ahmed Agrotechnology Discipline	Member
14	Professor Dr. Md. Enamul Kabir Agrotechnology Discipline	Member
15	Professor Dr. Md. Yamin Kabir Agrotechnology Discipline	Member
16	Professor Dr. Md. Matiul Islam Agrotechnology Discipline	Member
17	Professor Dr. Mst. Sabiha Sultana Agrotechnology Discipline	Member
18	Professor Dr. Shimul Das Agrotechnology Discipline	Member
19.	Bidhan Chandro Sarker Associate Professor, Agrotechnology Discipline	Member
20.	Rahima Nusrat Remme Associate Professor, Agrotechnology Discipline	Member
21.	Dr. Debesh Das, Associate Professor Agrotechnology Discipline	Member
22.	Joyanti Ray, Associate Professor Agrotechnology Discipline	Membe

Appendix 03: PSAC Committee

Sl. No.	Name and Address	Designation in Committee
01	Prof. Dr. Shamim Ahmed Kamal Uddin Khan	Chairman
02	Prof. Dr. Mohammad Bashir Ahmed	Member
03	Prof. Dr. Md. Shafiqul Islam	Member

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OBE
OUTCOME BASED EDUCATION

Agrotechnology Discipline
Life Science School
Khulna University
Khulna 9208, Bangladesh