

CURRICULA LAY-OUT FOR B. Sc. Ag. (Hons.) DEGREE

Level	S-1 (July-December)		S-2 (January-June)	
	Course (T,P)	Cr.hrs (T+P)	Course (T,P)	Cr.hrs (T+P)
Level-1	Agron 101,102	2+2	Agron 121,122	2+2
	SoilSc 101,102	2+2	Hort 121, 122	2+2
	FMech 101,102	2+2	Biochem 121,122	2+2
	Chem 101,102	3+2	AgStat 121,122	3+2
	AgEcon 101	3+0	RSoc 121	2+0
	Optional (one):		Elective (any one):	2+2
	English 101 (2+0)		AHusb 121,122 (2+2)	
	----- (2+0)		CompSc 121,122 (2+2)	
	Total (Excluding optional)	12+8	----- (2+2)	
			Optional (one):	
		English 101 (2+0)		
		----- (2+0)		
		Total (Excluding optional)	13+10	
Level-2	Agron 201, 202	2+2	Entom 221,222	3+2
	SoilSc 201, 202	3+2	PPath 221, 222	3+2
	Hort 201, 202	2+2	GPB 221, 222	2+2
	CBot 201, 202	3+2	AgExt 221, 222	3+2
	Biochem 201, 202	3+2	AgChem 221,222	2+2
	Total	13+10	Total	13+10
LEVEL-3	Hort 301, 302	3+2	Agron 321, 322	3+2
	GPB 301, 302	3+2	SoilSc 321, 322	3+2
	AgExt 301, 302	2+2	Entom 321, 322	3+2
	AgChem 301, 302	3+2	PPath 321, 322	3+2
	AgroF 301, 302	3+2	CBot 321, 322	2+2
	Total	14+10	Total	14+10
Level-4	Entom 401, 402	3+2	Agron 421, 422	3+2
	PPath 401, 402	3+2	SoilSc 421, 422	3+2
	CBot 401, 402	3+2	Hort 421, 422	3+2
	AgExt 401, 402	3+2	GPB 421, 422	3+2
	Elective (any one):	2+2	Elective (any one):	2+2
	Biotech 401,402(2+2)		Biotech 401, 402 (2+2)	
	EnvSc 401, 402 (2+2)		EnvSc 401,402 (2+2)	
	---- 401,402/etc(2+2)		----- 401, 402/etc (2+2)	
Total	14+10	Total	14+10	

Agron (12+10) = 22	PPath (9+6) = 15	AgChem (5+4) = 9
SoilSc (11+8) = 19	CBot (8+6) = 14	Biochem (5+4) = 9
Hort (10+8) = 18	GPB (8+6) = 14	AgroF (3+2) = 5
Entom (9+6) = 15	AgExt (8+6) = 14	Others (19+12) = 31
Total credit hrs (Theor. +Prac)		: 107+78 = 185
Total no. of courses (Theor.+Prac)		: 41+39 = 80

* Modified from the originally submitted one, and approved in the 141st Academic Council meeting held on 17th and 24th January, 2002 and approved by the syndicate in its 252nd meeting held on 23.3.2002.

Summary information on types of courses and credit requirement for B.Sc.Ag. (Hons) degree in the semester (cf. course lay-out)

Types of courses		Credits	Levels & semesters the credits to be earned from
(I)	Compulsory	173	All 4 levels (S-1, S-2)
(II)	Elective	12	Level – 1 (S-2) & Level – 4 (S-1, S-2)
(III)	Optional	4	Level – 1 (S-1, S-2)
Total earned credit requirement (Excluding optional) = 185			

Types of courses–compulsory/elective/optional to be offered by different departments at different levels (year) and semesters for B.Sc.Ag. (Hons) degree in the semester system from July 2002

Sl.	Course No. and Title	Credit	Contact hrs/wk	Available at	
				Level	Semester
1.	Department of Agronomy				
	<u>Compulsory:</u>				
	Agron 101: Fundamentals of Agronomy-Theory	2 cr	2hrs	L-1	S-1
	Agron 102: Introductory Agronomic Practices	2 cr	3 hrs	"	"
	Agron 121: Seed Science and Technology-Theory	2 cr	2 hrs	L-1	S-2
	Agron 122: Seed Science & Technology-Practical	2 cr	3 hrs	"	"
	Agron 201: Weed Science-Theory	2 cr	2 hrs	L-2	S-1
	Agron 202: Practical Weed Science-Practical	2 cr	3 hrs	"	"
	Agron 321 : Crop Husbandry-Theory	3 cr	3 hrs	L-3	S-2
	Agron 322 : Crop Husbandry-Practical	2 cr	3 hrs	"	"
	Agron 421 : Crop Production & Farm Management-Theory	3 cr	3 hrs	L-4	S-2
	Agron 422 : Crop Production & Farm Management-Practical	2 cr	3 hrs	"	"
	<u>Elective:</u>				
	Agron 401: Introductory Cropping System	2 cr	2hrs	L-4	S-1
	Agron 402: Practical Introductory Cropping System	2 cr	3 hrs	"	"
	Agron 423: Forage Crops and Pasture Management	2 cr	2 hrs	L-4	S-2
	Agron 424: Practical Forage and Pasture Crops	2 cr	3 hrs	"	"
2.	Department of Soil Science				
	<u>Compulsory:</u>				
	Soil Sc 101: Introductory Soil Science-Theory	2 cr	2 hrs	L-1	S-1
	Soil Sc 102: Soil Science-Practical – 1	2 cr	3 hrs	"	"
	Soil Sc 201: Soil Survey, Classification & Conservation- Theory	3 cr	3 hrs	L-2	S-1
	Soil Sc 202: Soil Science-Practical – 2	2 cr	3 hrs	"	"
	Soil Sc 321 : Soil Physics & Soil Chemistry- Theory	3 cr	3 hrs	L-3	S-2
	Soil Sc 322: Soil Science- Practical – 3	2 cr	3 hrs	"	"
	Soil Sc 421: Soil Microbiology & Soil Fertility-Theory	3 cr	3 hrs	L-4	S-2
	Soil Sc 422: Soil Science-Practical – 4	2 cr	3 hrs	"	"
	<u>Elective:</u>	-	-	-	-
	Soil Sc 401: Soil Biology-Theory	2 cr	2 hrs	L-4	S-1
	Soil Sc 402: Soil Pollution-Theory	2 cr	2 hrs	L-4	S-1
3.	Department of Entomology				
	<u>Compulsory:</u>				
	Entom 221: Fundamentals of Entomology-Theory	3 cr	3 hrs	L-2	S-2
	Entom 222: Fundamentals of Entomology-Practical	2 cr	3 hrs	"	"
	Entom 321: Insect Ecology & Pest Management-Theory	3 cr	3 hrs	L-3	S-2
	Entom 322: Insect Ecology & Pest Management-Practical	2 cr	3 hrs	"	"
	Entom 401: Economic Entomology-Theory	3 cr	3 hrs	L-4	S-1
	Entom 402: Economic Entomology-Practical	2 cr	3 hrs	"	"
	<u>Elective:</u> Not available				
4.	Department of Horticulture				
	<u>Compulsory:</u>				
	<i>Hort 121: Fundamental of Horticulture-Theory</i>	2 cr	2 hrs	L-1	S-2
	<i>Hort 122: Fundamental of Horticulture-Practical</i>	2 cr	3 hrs	"	"
	<i>Hort 201: Ornamental Horticulture & Plantation Crops-Theory</i>	2 cr	2 hrs	L-2	S-1
	<i>Hort 202: Ornamental Horticulture & Plantation Crops-Practical</i>	2 cr	3 hrs	"	"
	<i>Hort 301: Vegetables & Spice Crops-Theory</i>	3 cr	3 hrs	L-3	S-1
	<i>Hort 302: Vegetables & Spice Crops-Practical</i>	2 cr	3 hrs	"	"
	<i>Hort 421: Pomology-Theory</i>	3 cr	3 hrs	L-4	S-2
	<i>Hort 422: Pomology-Practical</i>	2 cr	3 hrs	"	"
	<u>Elective:</u>				
	<i>Hort. 401: Post harvest management of Hort Crops-Theory</i>	2 cr	2 hrs	L-4	S-1
	<i>Hort. 402: Postharvest Management of Horticulture Crops-Practical</i>	2 cr	3 hrs	"	"
	<i>Hort. 403: Commercial Horticulture-Theory</i>	2 cr	2 hrs	L-4	S-2
	<i>Hort. 404: Commercial Horticulture-Practical</i>	2 cr	3 hrs	"	"
5.	Department of Plant Pathology				

Sl.	Course No. and Title	Credit	Contact hrs/wk	Available at	
				Level	Semester
	Compulsory:				
	PPath 221: Fundamentals of Plant Pathology-Theory	3 cr	3 hrs	L-2	S-2
	PPath 222: Plant Pathology-Practical 1	2 cr	3 hrs	"	"
	PPath 321: Principles of Plant Pathology & Diseases of Field Crops-Theory	3 cr	3 hrs	L-3	S-2
	PPath 322: Plant Pathology-Practical 2	2 cr	3 hrs	"	"
	PPath 401 : Diseases of fruits, Vegetables, Cash Crops, Agro-forest trees and Seed Pathology-Theory	3 cr	3 hrs	L-4	S-1
	PPath 402: Plant Pathology-Practical 3	2 cr	3 hrs	"	"
	Elective:				
	PPath 404: Plant Disease Management-Practical	2 cr	3 hrs	L-4	S-1
	PPath 422: Plant Disease Clinic-Practical	2 cr	3 hrs	L-4	S-2
6.	Department of Crop Botany				
	Compulsory:				
	CBot 201: Plant Morphology, Embriology and Taxonomy & Embryology-Theory	3 cr	3 hrs	L-2	S-1
	CBot 202: Plant Morphology, Embriology and Taxonomy & Embryology-Practical	2 cr	3 hrs	"	"
	CBot 321: Plant Physiology & Ecology (I)-Theory	2 cr	2 hrs	L-3	S-2
	CBot 322 Plant Physiology & Ecology (I)- Practical	2 cr	3 hrs	"	"
	CBot 401: Plant Physiology and Ecology (II)-Theory	3 cr	3 hrs	L-4	S-1
	CBot 402: Plant Physiology and Ecology (II)- Practical	2 cr	3 hrs	"	"
	Elective:				
	CBot 421: Crop Physiology-Theory	2 cr	2 hrs	L-4	S-2
	CBot 422: Crop Physiology-Practical	2 cr	3 hrs	"	"
	CBot 423: Plant Biodiversity & Conservation-Theory	2 cr	2 hrs	L-4	S-2
	CBot 424 : Plant Biodiversity & Conservation-Practical	2 cr	3 hrs	"	"
7.	Department of Genetics & Plant Breeding				
	Compulsory:				
	GPB 221: Cytology-Theory	2 cr	2 hrs	L-2	S-2
	GPB 222: Cytology-Practical	2 cr	3 hrs	"	"
	GPB 301: Genetics and Cytogenetics-Theory	3 cr	3 hrs	L-3	S-1
	GPB 302: Genetics-Practical	2 cr	3 hrs	"	"
	GPB 421: Plant Breeding-Theory	3 cr	3 hrs	L-4	S-2
	GPB 422: Plant Breeding-Practical	2 cr	3 hrs	"	"
	Elective:				
	GPB 401: Biotechnology and Genetic Engineering-Theory	2 cr	2 hrs	L-4	S-1
	GPB 402: Biotechnology and Genetic Engineering-Practical	2 cr	3 hrs	"	"
	GPB 423: Special Plant Breeding – Theory	2 cr	2 hrs	L-4	S-2
	GPB 424: Special Plant Breeding – Practical	2 cr	3 hrs	"	"
8.	Department of Agricultural Extension Education				
	Compulsory:				
	AgExt 221: Fundamentals of Extension, Leadership and Motivatio Theory	3 cr	3 hrs	L-2	S-2
	AgExt 222: Extension Teaching Methods and Aids-Practical	2 cr	3 hrs	"	"
	AgExt 301: Extension Communication and Group Approaches-Theory	2 cr	2 hrs	L-3	S-1
	AgExt 302: Data Collection, Processing and Report Writing-Practical	2 cr	3 hrs	"	"
	AgExt 401: Extension Organization Management-Theory	3 cr	3 hrs	L-4	S-1
	AgExt 402: Extension Programme Planning and Outreach Programme-Practical	2 cr	3 hrs	"	"
	Elective:				
	AgExt 403: Extension for Sustainable Agricultural Development–Theory	2 cr	2 hrs	L-4	S-1
	AgExt 404: Extension for Sustainable Agricultural Development–Practical	2 cr	3 hrs	"	"
	AgExt 421: Community Participation-Theory	2 cr	2 hrs	L-4	S-2
	AgExt 422: Community Participation – Practical	2 cr	3 hrs	"	"

Sl.	Course No. and Title	Credit	Contact hrs/wk	Available at	
				Level	Semester
9.	Department of Agricultural Chemistry				
	Compulsory:				
	AgChem 221: Nuclear and Agro-industrial Chemistry – Theory	2 cr	2 hrs	L-2	S-2
	AgChem 222: Nuclear and Agro-industrial Chemistry- Practical	2 cr	3 hrs	"	"
	AgChem 301: Plant Nutrition, Pesticide and Environmental Chemistry –Theory	3 cr	3 hrs	L-3	S-1
	AgChem 302: Plant Nutrition, Pesticide and Environmental Chemistry – Practical	2 cr	3 hrs	"	"
	Elective:				
	AgChem 401: Bioenergy – Principles & Practices – Theory	2 cr	2 hrs	L-4	S-1
	AgChem 402: Bioenergy – Principles and Practices – Practical	2 cr	3 hrs	"	"
	AgChem 421: Micro nutrients in agriculture –Theory	2 cr	2 hrs	L-4	S-2
	AgChem 422: Micro nutrients in Agriculture- Practical	2 cr	3 hrs	"	"
10.	Department of Biochemistry				
	Compulsory:				
	Biochem 121: Chemistry of Biomolecules-Theory	2 cr	2 hrs	L-1	S-2
	Biochem 122: Chemistry of Biomolecules-Practical	2 cr	3 hrs	"	"
	Biochem 201: Metabolism and Human Nutrition-Theory	3 cr	3 hrs	L-2	S-1
	Biochem 202: Metabolism and Human Nutrition-Practical	2 cr	3 hrs	"	"
	Elective:				
	Biochem 401: Fundamentals of Molecular Biochemistry & Biotechnology-Theory	2 cr	2 hrs	L-4	S-1
	Biochem 402: Fundamentals of Plant Biochemistry-Practical	2 cr	3 hrs	"	"
11.	Department of Chemistry				
	Compulsory:				
	Chem 101: Chemistry – Theory	3 cr	3 hrs	L-1	S-1
	Chem 102: Chemistry – Practical	2 cr	3 hrs	"	"
12.	Department of Agroforestry				
	Compulsory:				
	AgroF 301: Principles of Agroforestry – Theory	3 cr	3 hrs	L-3	S-1
	AgroF 302: Principles of Agroforestry – Practical	2 cr	3 hrs	"	"
	Elective: Not available	-	-	-	-
13.	Department of Language				
	Optional:				
	Lang 101: English Language	2 cr	2 hrs	L-1	S-1,2
14.	Department of Agricultural Economics				
	Compulsory:				
	AgEcon 101: Agricultural Economics	3 cr	3 hrs	L-1	S-1
15.	Department of Rural Sociology				
	Compulsory:				
	RSoc 121: Rural Sociology	2 cr	2 hrs	L-1	S-2
16.	Department Agricultural Statistics				
	Compulsory:				
	AgStat 121: Agricultural Statistics- Theory	3 cr	3 hrs	L-1	S-2
	AgStat 122: Agricultural Statistics – Practical	2 cr	3 hrs	"	"
17.	Department of Farm Power & Machinery				
	Compulsory:				
	FMech 101: Farm Mechanics – Theory	2 cr	2 hrs	L-1	S-1
	FMech 102: Farm Mechanics – Practical	2 cr	3 hrs	"	"
18.	Department of Animal Science				
	Elective:				
	AS 121: Animal Science – Theory	2 cr	2 hrs	L-1	S-2
	AS 122: Animal Science – Practical	2 cr	3 hrs	"	"
19.	Department of Biotechnology				
	Elective:				
	Biotech 401: Theory (cf. GPB: 401)	2 cr	2 hrs	L-4	S-1,2
	Biotech 402: Practical (cf. GPB: 402)	2 cr	3 hrs	"	"

Sl.	Course No. and Title	Credit	Contact hrs/wk	Available at	
				Level	Semester
20.	Department of Environmental Science				
	Elective:				
	EnvSc 401: Theory (Not available)	2 cr	2 hrs	L-4	S-1, 2
	EnvSc 402 : Practical (Not available)	2 cr	3 hrs	"	"
21.	Department of Computer Science & Mathematics				
	Elective:				
	CompSc 121: Theory (Not available)	2 cr	2 hrs	L-1	S-2
	CompSc 122: Practical (Not available)	2 cr	3 hrs	"	"

SYLLABUS FOR B.SC. AG. (Hons.) DEGREE

DEPARTMENT OF AGRONOMY

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Title	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
AGRON 111: Fundamentals of Agronomy-Theory	2 cr	2hrs	L-1	S-1
AGRON 112: Introductory Agronomic Practices-P	2 cr	3 hrs	"	"
AGRON 121: Seed Science and Technology-Theory	2 cr	2 hrs	L-1	S-2
AGRON 122: Seed Science & Technology-Practical	2 cr	3 hrs	"	"
AGRON 211: Weed Science-Theory	2 cr	2 hrs	L-2	S-1
AGRON 212: Weed Science-Practical	2 cr	3 hrs	"	"
AGRON 321 : Crop Husbandry-Theory	3 cr	3 hrs	L-3	S-2
AGRON 322 : Crop Husbandry-Practical	2 cr	3 hrs	"	"
AGRON 421 : Crop Production & Farm Management-T	3 cr	3 hrs	L-4	S-2
AGRON 422 : Crop Production & Farm Management-Practical	2 cr	3 hrs	"	"
Elective:				
AGRON 411: Introductory Cropping Systems—Theory	2 cr	2hrs	L-4	S-1
AGRON 412: Introductory Cropping Systems-Practical	2 cr	3 hrs	"	"
AGRON 423: Forage Crops and Pasture Management-T	2 cr	2 hrs	L-4	S-2
AGRON 424: Forage Crops and Pasture Crops- Practical	2 cr	3 hrs	"	"

Level-4, Semester-2

AGRON 421: Crop Production and Farm Management-Theory, 3 Credits, 3 hrs/wk

Production Technology of Crops: Origin, climate and soil requirements, characteristics of species and cultivars, cultivation practices, post-harvest operations and cost of production of the following crops.

Fibre Crops : Jute, cotton, sunnhemp and kenaf

Oil Crops: Mustard, sesame, groundnut, soybean, linseed, sunflower, safflower and castor.

Beverage Crops- Tea, coffee.

Forage crops- Maize, sorghum, grasspea, cowpea, napier grass and guinea grass.

Quality Control of Crops: Factors affecting the quality of crops. Agronomic means of improving quality of crops.

Land use and Crop Statistics in Bangladesh: Categories of land use system, area, production, and yield of crops of Bangladesh over time.

Farm Planning and Management: Factors to be considered for the establishment of a farm. Farm layout and farm budgeting. Farm record keeping. Principles of selection of farm enterprises.

Cropping Scheme: Utility and principles of preparation.

Agro-ecosystem: Concept, system properties, determinants, types, resources, characteristics of farming systems of Bangladesh.

Cropping Systems: Concept and determinants.

- a) Multiple cropping: Objective, types, advantages and disadvantages.
- b) Crop rotation: Planning of crop rotation
- c) Crop diversification: Concept, importance, present status and future strategy in Bangladesh.
- d) Crop intensification: Concept, importance, and limitations.
- e) Cropping patterns of Bangladesh and possibilities of their improvement.

Crop Calendar: Objectives, utility, procedure of preparation.

Crop Evaluation: Crop yield estimation, crop cutting experiment, crop reporting, and crop forecasting.

AGRON 422: Crop Production and Farm Management-Practical, 2 Credits, 3 hrs/wk

1. Project paper: Conducting a simple experiment to study the effect of agronomic practices on crop production and to prepare a project report.
2. Study of farm records and their maintenance.
3. Preparation of cropping scheme.
4. Laying out an agricultural farm.
5. Conducting crop cutting experiment.
6. Preparation of a crop report.
7. Computation of production cost of crops included in Course No. Agron. 421.
8. Preparation of crop rotation schedules.
9. Study of land utilization and crop statistics of Bangladesh.
10. Study of major cropping patterns of Bangladesh in relation to climatic parameters.

Text and Reference Books

Beneke, R.R. 1966. Managing the Farm Business. John Wiley and Sons, Inc. New York, London, Sydney.
Chatterjee, B.N.; Maiti, S. and Mandal, B.K. 1989. Cropping System (Theory and Practice) Second Ed. Oxford and IBH Publishing Co. Pvt. New Delhi, Bombay, Calcutta, 345p.
Efferson, J.M. 1953. Principles of Farm Management. McGraw-Hill Book Co., New York.
Hedges, T.R. 1969. Farm Management Decision. Prentice Hall, Inc. Englewood Cliffs. London.
Hoque, M.Z. 1984. Cropping Systems in Asia. On-Farm Research and Management. IRRI, Philippines.
Kipps, M.S. 1978. Production of Field Crops. 6th Edition. Tata McGraw-Hill Publishing Company Ltd. New Delhi, India, 790p.
Kundu, D.; Basak, K.C. and Sarker, P.D. 1959. Jute in India. Indian Central Jute Committee, Calcutta, India.
Martin, J.H., Leonard, W.H. and Stamp, D.L. 1967. Principles of Field Crop Production. 3rd Edition. McMillan Pub. Co. Inc: New York. 1118p.
Quddus, M.A. 1985. Bangladesher Khadya Shasya O Arthakari Phsaal. Bangla Academy, Dhaka. 403p.
Thakur, C. 1979. Scientific Crop Production. Vol. I and II. 3rd Edition Metropolitan Book Co. Pvt. Ltd. 1, Netaji Subhash Marg, New Dehli-110002, India.

Level-4, Semester-1 (Elective)

AGRON 411: Introductory Cropping Systems-Theory, 2 Credits, 2 hrs/wk

Systems: Concept and properties. Agro-ecosystems- importance, structure and function. Systems approach in agriculture- objectives and importance.

Cropping Systems: Concept and determinants. Cropping systems of Bangladesh.

Cropping Pattern: Concept, objectives. Types of multiple cropping patterns. Ecological framework for multiple cropping- Diversity and productivity relationships.

Plant Interactions in Multiple Cropping Systems: Interference interactions-removal and addition interactions, mutualisms, interaction of mechanism. Factors affecting the selection of species combination- principles and practices.

Major Types of Intercropping: Intercropping systems of cereals with low-canopy legumes. Intercropping of cereals with cereals, legumes with cereals, multicrop intercropping. Forage crops in the intercropping systems. Major intercropping patterns in Bangladesh.

Cultural Management of Crops in Intercropping Systems: Seedling environment- tillage, cultivation and weed control. Planting dates, patterns and densities. Soil fertility management- principles of fertilizer recommendation based on different cropping systems. Pest management in intercropping.

Special Cropping Systems: Rice-fish systems: alternate and simultaneous, importance and scope. Rice culture under the rice-fish systems- technology and management.

AGRON 412: Introductory Cropping Systems-Practical, 2 Credits, 3 hrs/wk

1. Agro-ecosystem analysis of any village near BAU Campus.
2. Crop suitability assessment based on land and soil type.
3. Canopy measurement of shoot in inter and sole crop(s).
4. Study of root in intercropping pattern: root spread, pattern of distribution of roots in sole and intercrops.
5. Computation of LER, IER and yield equivalent in intercropping patterns.
6. Analysis of resource utilization efficiency (RUE) in intercrops.
7. Computation of fertilizer requirement of crops based on cropping patterns.
8. A plot will be assigned to each student for growing intercrop(s) and evaluate their performance.

Text and Reference Books

- Beets, C.W. 1983. Multiple Cropping and Tropical Farming Systems. Westview Press.
- Chatterjee, B.N.; Mati, S. and Mandal, B.N. 1989. Cropping systems- Theory and Practice (2nd Ed.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Francis, C. A. 1986. Multiple Cropping System. Macmillan Publishing Co. New York.
- Hossain, S.M.A. 1988. Agricultural and Rural Development in Bangladesh- Evolution of Cropping Systems in Mymensingh and Comilla Regions. JSARD Pub. No. 12. Japan International Cooperation Agency, Dhaka, Bangladesh.
- Spedding, C.R.W. 1988. An Introduction to Agricultural Systems (2nd Ed.). Elsevier Applied Science. London, New York.
- Zandstra, H.G.; Price, L. and Morris, R.A. 1981. A Methodology for On-farm Cropping Systems Research. IRRI. Los Banos, Philippines.

Level-4, Semester-2 (Elective)

AGRON 423: Forage Crops and Pasture Management-Theory, 2 Credits, 2 hrs/wk

Forage and Pasture Management: Concept, types, classification, importance, scope, relationship with agriculture. Terminology of forage and pasture science. Feasibility of pasturing in Bangladesh. Forage crops production in the existing cropping systems.

Forage Crops: Concept, classification, characteristics.

Grass-legume combination and their contribution in pasture science. Crop husbandry of grass and legume species:

Grass species: Maize, sorghum, guinea grass, paragrass, napier grass, pangola and carpet grass.

Legume species: Grasspea, berseem, cowpea, clovers, *Sesbania* and sunnhemp.

Forage and Pasture Plant Nutrition : Concept, importance, nutrient recycling- nitrogen fixation, nitrogen cycle, legume nitrogen versus artificial nitrogen, nutrient recycling and animal movement.

Pasture Establishment: Destruction of previous vegetation. Preparation of seed bed; time, depth and method of sowing, cover crops, pasture renovation by over drilling, seed quality, Inoculation and pelleting of legume seed, management of establishing pasture.

Grazing Management- Pasture herbage quality, pasture herbage yield, influence of animals on pasture composition and yield, grazing systems and livestock performance; pasture herbage utilization.

Forage and Pasture Conservation: Hay, straw and silage- On-site conservation and effect on animal health.

AGRON 424: Forage Crops and Pasture Crops- Practical, 2 Credits, 3 hrs/wk

1. Identification of different forage and pasture species.
2. Preparation of forage and pasture seed album.
3. Preparation of forage and pasture plant herbarium.
4. Preservation of hay.
5. Preservation of silage.
6. Preservation of straw.
7. Measurement of botanical composition of a pasture.
8. Raising a forage crop in individual plot.

Text and Reference Books

- Holmes, W. 1987. Grass- its production and utilization. The British Grassland Society. Blackwell Scientific Publications, London.
- Langer, R.H.M. 1973. Pasture and Pasture Plants. A.H. and A.W. Reed Ltd. Wellington, Sydney, London.
- Pearson, C.J. and Ison, R.L. 1987. Agronomy of Grassland Systems. Cambridge University Press, New York, Sydney.
- Van Der Meer, H.G.; Fyden, J.C. and Ennik, G.C. 1986. Nitrogen fluxes in intensive grassland systems. Martinus Nijhoff Publishers. The Netherlands.
- White, J.G.H. 1989. Herbage Seed Production. Wellington, New Zealand.
- Whitehead, D.C. 1970. The role of nitrogen in grassland productivity. Commonwealth Agricultural Bureau, England.

DEPARTMENT OF SOIL SCIENCE

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Titles	Credit	Contact hrs/wk	Available at	
			Level	Semester

Compulsory:				
SS 111: Introductory Soil Science-Theory	2 cr	2 hrs	L-1	S-1
SS 112: Introductory Soil Science-Practical	2 cr	3 hrs	"	"
SS 211: Soil Survey, Classification & Conservation-Theory	3 cr	3 hrs	L-2	S-1
SS 212: Soil Survey, Classification & Conservation- Practical	2 cr	3 hrs	"	"
SS 321 : Soil Physics & Soil Chemistry- Theory	3 cr	3 hrs	L-3	S-2
SS 322: Soil Physics & Soil Chemistry – Practical	2 cr	3 hrs	"	"
SS 421: Soil Microbiology & Soil Fertility-Theory	3 cr	3 hrs	L-4	S-2
SS 422: Soil Microbiology & Soil Fertility - Practical-4	2 cr	3 hrs	"	"
Elective:	-	-	-	-
SS 411: Soil Biology-Theory	2 cr	2 hrs	L-4	S-1
SS 412: Soil Biology –Practical	2 cr	2 hrs	"	"
SS 423: Soil Pollution –Theory	2 cr	2 hrs	L-4	S-2
SS 424: Soil Pollution-Practical	2 cr	2 hrs	"	"

Level-4, Semester-2

SS 421: Soil Microbiology and Soil Fertility- Theory, 3 Credits, 3 hrs/wk

SOIL MICROBES

Abundance and distribution in soils

Microbial interactions in soils

Microbes and soil fertility

BIOLOGICAL NITROGEN FIXATION

Symbiotic N₂-fixation - Legume-*Rhizobium* symbiosis, *Azolla-Anabaena* symbiosis

Non-symbiotic N₂-fixation – Azotobacter, Azospirillum, Cyanobacteria

BIO-FERTILIZERS

Biofertilizers – types and importance

Mychorrhiza – types and importance

Nutrient availability in soils

Nitrogen – occurrence, mineralization, immobilization, mechanisms of N loss, N cycle

Phosphorus and potassium – occurrence, fixation and availability

Sulphur – occurrence, mineralization, immobilization, oxidation and reduction

Zinc and boron - occurrence and availability

Fertilizer management

Principles of fertilizer use

Rationale of fertilizer use

Methods of fertilizer application

Fertilizer use efficiency

SOIL FERTILITY AND EVALUATION

METHODS OF SOIL FERTILITY EVALUATION

SOIL TESTING, FERTILIZER TRIAL, CRITICAL LIMITS, FERTILIZER RECOMMENDATION

SOIL FERTILITY PROBLEMS AND MANAGEMENT IN BANGLADESH

Soil fertility problems – extent and causes of organic matter depletion, nutrient mining, unbalanced use of fertilizers, and land degradation.

Soil fertility management – use of FYM, compost, green manure, organic wastes, crop residues, and integrated nutrient management.

SS 422: Soil Microbiology and Soil Fertility - Practical-4, 2 Credits, 3 hrs/wk

1. Determination of N, P and K in soil by BAU Soil Testing Kit
2. Determination of total N in soil by Kjeldahl method
3. Determination of available P in soil by modified Olsen method
4. Determination of available K in soil by ammonium acetate extraction method
5. Determination of available S in soil by calcium chloride extraction method
6. Determination of available Zn in soil by DTPA extraction method
7. Techniques for culturing bacteria
8. Isolation and authentication of *Rhizobium* from legume root nodules
9. Preparation of *Rhizobium* inoculants
10. Total count of bacteria in rhizobial inoculant
11. Isolation and identification of *Azotobacter* in soil by Brown method
12. Preparation of cyanobacterial inoculant

Text and Reference Books

Brady N.C. 1996. The Nature and Properties of Soils. Macmillan Pub. Co. Inc., New York.
 Elsan, J.D.V., Trevors, J.T. and Elizabeth, M.H.W. 1997. Modern Soil Microbiology. Marcel Dekker.
 Mengel, K. and Kirkby, E.A. 1987. Principles of Plant Nutrition. Int. Potash Inst. Pub. Switzerland.
 Page, A.L., Miller, R.H. and Keeney, D.R. 1982. Methods of Soil Analysis, Part 2. Amer. Soc. Agron., Inc. Pub. Madison, Wis., USA.
 Stevenson, F.J. 1985. Cycles of Soils – Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons Inc., New York.
 Subba Rao, N. S. 1984. Biofertilizers in Agriculture. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.
 Thomson, L.M. and Troeh, F.R. 1978. Soils and Soil Fertility. McGraw Hill, New York.
 Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. 1999. Soil Fertility and Fertilizers. Macmillan Pub. Co., New York.
 Vincent, J.M. 1982. Nitrogen Fixation in Legumes. Academic Press, Paris, San Diego, Tokyo, Toronto.
 Singh, D. Chhonkar, P.K. and Pandey, R.N. 1999. Soil Plant Water Analysis. A Methods Manual. ICAR, New Delhi.

Level-4, Semester-1 (Elective)

SS 411: Soil Biology- Theory, 2 Credits, 2 hrs/wk

Soil organisms

Soil as a habitat for organisms
 Occurrence, diversity and classification of soil organisms
 Factors affecting the activities and distribution of organisms in soils
 Rhizosphere organisms and their influence on crops
 Beneficial and harmful organisms in soil

Bioactivity in soil

Organisms involved in biochemical processes in soils
 Compost technology; macro and microorganisms involved in composting, vermicomposting, compost maturity

Soil organisms and the environment

Role of soil organisms in improving soil health
 Effect of agricultural practices on soil organisms
 Biodegradation of pesticides

Text and Reference Books

Alexander, M. 1977. Introduction to Soil Microbiology. John Wiley and Sons Inc. New York.
 Brock, T.D., Smith, D.W. and Madigan, M.T. 1984. Biology of Microorganisms.
 Smith, R.L. 1990. Ecology and Field Biology. 4th edn. West Virgin University. Harper Collins Publishers, USA.
 Collins, W.W. and Qualset, C.O. 1999. Biodiversity in Agroecosystems. CRC Press, UK.
 Elsan, J.W.V., Trevors, J.T. and Elizabeth, M.H.W. 1997. Modern Soil Microbiology. Marcel Dekker.
 Paul, E.A. and Clark, F.E. 1989. Soil Microbiology and Biochemistry. Academic Press Inc. London.
 Stevenson, F.J. 1985. Cycles of Soils – Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons Inc., New York.
 Subba Rao, N. S. 1984. Biofertilizers in Agriculture. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.

SS 412: Soil Biology- Practical, 2 Credits, 2 hrs/wk

1. Sampling of soils for microbial study.
2. Preparation of culture media for microbes.
3. Study on the microbial population of the soil: bacteria, fungi & cyanobacteria.
4. Isolation and identification of cyanobacteria in soils.
5. Isolation and characterization of Azospirillum in soils.
6. Study on the rhizospheric organisms.
7. Identification of earthworms.

References

1. David Pramer and E.L. Schemidt. Experimental Soil Microbiology. Burgen Publishing Company.
2. S.A. Waksman. Soil Microbiology. John Wiley and Sons. Inc. N.Y.
3. R. Krishnamurthy, 1978. A manual on compost and other organic manures. Today and Tomorrows Printers & Publishers.
4. Harry. W.S. and Paul, J. 1972. Microbes in Action. A laboratory manual in Microbiology. 2nd ed. W.H. Fruman Company, Sanfrancisco, USA.
5. Vincent, J.M. J.M. 1970. A Manual for the Practical Study of Root Nodule Bacteria IBP Handbook No. 15.

Level-4, Semester-2 (Elective)

SS 423: Soil Pollution-Theory, 2 Credits, 2 hrs/wk

Introduction to pollution

Concept of pollution and soil pollution

Hazards of soil pollution

Arsenic pollution in Bangladesh

Sources of soil pollution

Fertilizers – residues and toxicity

Pesticides - residues, hazards and degradation

Heavy metals – sources and hazards

Radioactive materials – hazards

City wastes, sewage sludge, soil degradation and microbes

Remediation of soil pollution

Judicial use of fertilizers and pesticides, waste management, soil management

Text and Reference Books

Kudesia, V.P. 1990. Pollution, Pragati Prakashsni, India.

Mishra, P.C. 1989. Soil Pollution : Soil organisms. Asia Pub. House, India.

Tan, K.H. 2000. Environmental Soil Science, 2nd edition, Revised and Expanded. Marcel Dekker Inc. USA/Canada/South America.

Agrawal, S.B. and Agrawal, M. 2000. Environmental pollution and Plant Responses. Cat. No. L.1341, CRC Press, UK.

ASA. 1990. Impact of Carbon Dioxide, Trace Gases, and Climate Change on Global Agriculture. ASA Special Pub. No. 53, USA.

ASA. 1993. Agricultural Ecosystem effects on Traces Gases, and Global Climate Change. ASA Special Pub. No. 55, USA.

Orlov, D.S. 1992. Soil Chemistry. Oxford Pub. Co. Cal. India.

Rahman, A.A. Huq, S., Haider, R. and Jansen, F. 1992. Environment and Development in Bangladesh. Bang. Cent. Adv. Stud., Dhaka.

SS 424: Soil Pollution-Practical, 2 Credits, 2 hrs/wk

1. Determination of heavy metals (Zn.Cd.As & Pb) in soils.
2. Determination of heavy metals (ZnCd.As & Pb) in fertilizers.
3. Determination of heavy metals (Zn.Cd.As & Pb) in organic manure and wastes.
4. Determination of DTPA extractable Fe,Zn,Mn & Cu in soils.
5. Determination of As content in water.
6. Determination of phosphate and nitrate in water.
7. Determination of HCO₃ concentration in submerged soils.

References

1. Page, A.L. Miller, R.H. and Keeney. D.R. 1989. Methods of Soil Analysis, Part-2. Amer. Soc. Agron. Inc., Soil Sci. Soc., Inc. Madison, Wisconsin, USA.
2. Hesse. P.R. 1994. A text book of Soil Chemical Analysis. Sataish Kumar Jain for CBS. Jain Bhawan. Bhola Nath Nagar, Shadara, Delhi 110032.

DEPARTMENT OF ENTOMOLOGY

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Title	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
ENTOM 221: Fundamentals of Entomology (Theory)	3 cr	3 hrs	L-2	S-2
ENTOM 222: Fundamentals of Entomology (Practical)	2 cr	3 hrs	"	"
ENTOM 321: Insect Ecology & Pest Management (Theory)	3 cr	3 hrs	L-3	S-2
ENTOM 322: Insect Ecology & Pest Management(Practical)	2 cr	3 hrs	"	"
ENTOM 411: Economic Entomology (Theory)	3 cr	3 hrs	L-4	S-1
ENTOM 412: Economic Entomology (Practical)	2 cr	3 hrs	"	"

Elective: (Not available)	-	-	-	-
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Level-4, Semester-1

ENTOM 411: Economic Entomology- Theory, 3 credits, 3 hrs/wk

Field crop pests: Bioecology, nature of damage and control measures of major insect and mite pests of rice, wheat, jute, cotton, sugarcane, pulses, oilseeds, tobacco and tea.

Horticultural crop pests: Bioecology, nature of damage and control measures of major insect and mite pests of vegetables, fruits, ornamental plants and spices. Nursery pests.

Forest pests: Bioecology, nature of damage and control measures of major insect and mite pests of forest plants.

Storage pests: Important insect and mite pests in storage; their life cycle and nature of damage. General control measures of storage pests.

Vertebrate pests: Important vertebrate pests of field crops and stored products. Population dynamics. Rodent damage assessment. Control measures of rodents pests.

Insect borne plant diseases: Insects in relation to plant diseases. Role of insects in plant disease development. Methods of transmission of pathogens by insects. Toxicoses and cecidium.

Industrial insects: Silkworm, Honey bee and Lac insect.

ENTOM 412: Economic Entomology- Practical, 2 credits, 3 hrs/wk

1. Survey of major pests of field crops, horticultural crops, forest plants and stored products.
2. Identification of important nursery pests.
3. Identification of potential predators, parasitoids and pathogens of insect pests in Bangladesh.
4. Identification of insects carrying disease organisms of major crops in Bangladesh.
5. Development of IPM programme for a cereal, fibre, vegetable and fruit crop.
6. Rearing technique of silkworm, honey bee and lac insect.
7. Mass culture of a pest insect and biocontrol agent.

Text and Reference Books

Atwal, A.S. 1976. Agricultural pests of India and Southeast Asia. Kalyani Publ., New Delhi.

Nayar, K. K., Ananthkrishnan, T. N. and David, B. V. 1985. General and applied Entomology. Tata McGraw- Hill Publ. Co. Ltd., India.

Prodhan, S. 1992. Insect pests of crops. National Book Trust, India.

Verma, D.K. 1999. Applied Entomology. Mittal Publ., India.

Ahad, A., Roy, M. and Sardar, M.A. 1987. Krishi Kitbiggan (in Bengali), Bidhayan Prakashana, Dhaka.

Alam, M. Z. 1969. Insect pests of vegetables and their control in Bangladesh. Agri. Inform. Serv., Dhaka.

Alam, S.N. and Sarker, D. 2000. Bangladeshe Lakhkhar Chash (in Bengali). Lakhkha Gobeshana Kendra, Nawbabgonj, Bangladesh.

Carter, W.1973. Insects in relation to plant disease. John Wiley, New York.

Cotton, R. T. 1963. Pests of stored grain and grain products. Burgess Publ. Co. Minn., USA.

Fryer, J.C.F. 1999. Insect pests of fruit crops. Biotech Books, India.

Gapud, V. P. 1992. Insect and mite pests of plant crops in Bangladesh and their natural enemies. USAID/BARC/Checchi & Co. Publ.

Heinrichs, E.A. 1994. Biology and Management of rice insects. Wiley Eastern Ltd., India.

Hiware, C.J. 2001. Agro cottage industry sericulture. Daya Publ., India.

Hossain, A.B.M.A. and Sharif, M. 1993. Mousmachi Palan Bidha (in Bengali). Bangla Academy Press, Dhaka.

Krishnaswami, S., Warasimhanna, M.N. Suryanarayan, S.K. and Kumararaj, S. 1979. Sericulture Manual 2 - Silkworm rearing. FAO, Italy.

Leach, J.G. 1994. Insect transmission of plant diseases. McGraw-Hill Book Company, Inc., New York and London.

Moite, D. K. 1994. Mousmachi Palan (in Bengali). Ma Tara Printing Press, Kalikata, India.

Pirone, P.P. 1978. Diseases and pests of ornamental plants. John Wiley and Sons, Inc. USA.

Posamentier, H. and Elsen, A. V. 1984. Rodent pests- their biology and control in Bangladesh. BRAC Printers, Dhaka.

Sathe, T. V. 2001. Cotton pests and biocontrol agents. Daya Publ., India

Singh, S. 1982. Beekeeping in India. Indian Council of Agricultural Research, New Delhi.

Zakladnoi, G.A. and Ratanova, V.F. 1987. Stored- grain pests and their control. Oxonian Press Pvt. Ltd., New Delhi.

DEPARTMENT OF HORTICULTURE

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Title	Credit	Contact	Available at
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		hrs/wk	Level	Semester
Compulsory:				
HORT 121: Fundamentals of Horticulture-Theory	2 cr	2 hrs	L-1	S-2
HORT 122: Fundamentals of Horticulture- Practical	2 cr	3 hrs	"	"
HORT 211: Ornamental Horticulture & Plantation Crops-Theory	2 cr	2 hrs	L-2	S-1
HORT 212: Ornamental Horticulture & Plantation Crops- Practical	2 cr	3 hrs	"	"
HORT 311: Vegetables & Spice Crops- Theory	3 cr	3 hrs	L-3	S-1
HORT 312: Vegetables & Spice Crops- Practical	2 cr	3 hrs	"	"
HORT 421: Pomology- Theory	3 cr	3 hrs	L-4	S-2
HORT 422: Pomology- Practical	2 cr	3 hrs	"	"
Elective:				
HORT 411: Postharvest management of Horticultural Crops-Theory	2 cr	2 hrs	L-4	S-1
HORT 412: Postharvest Management of Horticultural Crops-Practical	2 cr	3 hrs	"	"
HORT 423: Commercial Horticulture- Theory	2 cr	2 hrs	L-4	S-2
HORT 424: Commercial Horticulture- Practical	2 cr	3 hrs	"	"

Level- 4, Semester-2

HORT 421: Pomology-Theory, 3 Credits, 3 hrs/wk

- 1. General aspects of fruit production in Bangladesh:** Scope, importance, classification, area, production and factors affecting distribution of fruits in Bangladesh. Major fruit growing regions of the world.
- 1. Propagation of fruit plants:** Physiological and anatomical aspects of vegetative propagation. Stionic relationship and incompatibility. Micropropagation and its principles, stages and techniques.
- 3. Establishment and management of fruit orchards and homestead gardens :** Concept, site selection, land development and planting plans and orchard management practices. Bearing habit and its implications. Unfruitfulness–causes and remedies; use of growth regulators in fruit industry.
- 2. Physiology of flowering, fruit set and fruit development :** Factors influencing flower bud initiation, differentiation, pollination, fertilization, fruit set, growth, development, parthenocarp and seedlessness.
- 3. Production technology of fruits :** Origin, morphology, production statistics, soil, climate, varieties, propagation, cultural practices, pest management, harvesting, yield and improvement: Banana, pineapple, papaya, mango, jackfruit, litchi, guava, jujube, coconut, citrus fruits. Important minor and exotic fruits of Bangladesh.
- 5. Post-harvest management of fruits:** Post harvest physiology, factors affecting post harvest quality and shelf life, causes of spoilage and remedies.

HORT 422: Pomology- Practical, 2 Credits, 3 hrs/wk

1. Identification of common fruit plants of Bangladesh.
2. Identification of cultivated varieties of important fruits.
3. Morphological features of important fruit plants.
4. Preparation of different planting plans for orchards.
5. Practices on layout, planting, manuring, fertilizing, training, pruning and other cultural operations of orchards.
6. Acceleration of fruit seed germination.
7. Preparation and application of starter and hormone solutions.
8. Practicing vegetative propagation methods of common fruit plants of Bangladesh.
9. Costing of cultivation of mango, banana, papaya and pineapple.
10. Determination of brix of fruits.
11. Determination of fruit volume and texture.
12. Determination of ripeness of fruits.

Text and Reference Books

- Bose T.K. and S.K. Mitra. 1995. Fruits: Tropical and Subtropical. Naya Prokash, 106, Bidhan Sarani, Calcutta-6, India.
- Bose, T.K., S.K. Mitra and M.K. Sadhu. 1990. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash, 206, Bidhan Sarani, Calcutta-6, India.
- De. K.K. 1992. An Introduction to Plant Tissue Culture. New Central Book Agency, Calcutta.
- Gardner, V.E.F.C. Bradford and M.D. Hooker. 1952. Fundamentals of Fruit Production. McGraw Hill Book Company, New York.
- Hartmann, H.T., D.E. Kester and F.T. Davies Jr. 1990. Plant Propagation: Principle and Practices. Prentice-Hall, Iner Editions.

Mondal, M.F. 2000. Production and Storage of Fruits (in Bangla). Published by Mrs. Afia Mondal, BAU Campus, Mymensingh.
 Mukhopadhyaya, S. 1995. Commercialization of Micropropagated Plants in India. New Delhi
 Ryogo, K. 1988. Fruit Culture. Its Science and Art. John Wiley and Sons. New York.
 Samson, J.A. 1980. Tropical Fruits. Longman, London & New York.
 Singh, A. 1986. Fruit, Physiology and Production. Kalyani Publishers, New Delhi.

Level- 4, Semester-1 (Elective)

HORT 411: Postharvest Management of Horticultural Crops-Theory, 2 Credits, 2 hrs/wk

1. **Postharvest management of horticultural crops** : Concept, importance, scope and present situation of postharvest activities on horticultural crops in Bangladesh.
2. **Preharvest factors affecting postharvest quality** : Agroclimate, cultural management, and maturity.
1. **Postharvest physiology**: Respiration, transpiration, ethylene production, ripening, sprouting, physical and chemical changes.
2. **Harvesting and postharvest handling** : Harvesting, cooling, cleaning, curing, sorting, grading, packaging, transportation and marketing.
3. **Technology of storage**: Principles and methods of different types of storage including CA, MA, refrigerated and traditional storage.
4. **Processing and preservation** : Objective, principles and methods, preparation of value added products.

HORT 412 Postharvest Management of Horticultural Crops- Practical, 2 Credits; 3 hrs/wk

1. Determination of maturity indexes of horticultural crops.
2. Quality assessment of fruits through determination of colour, texture and brix.
3. Preparation of packaging materials for transport and marketing.
4. Visit and report writing on traditional and refrigerated storage of horticultural crops.
5. Regulation of ripening through traditional methods.
6. Regulation of ripening through chemicals.
7. Preparation of juice, jam, canned products, jellies and sauces..

Text and Reference Books

Bose, T. K. and S. K. Mitra. 1990. Fruits: Tropical and Subtropical. Naya Prokash, 206 Bidhan Sarani, India.
 Chadha K.L., B.M.C. Reddy and S.D. Shikhamany. 1998. Pineapple. ICAR, India
 Edmond J.B, T.L Senn., F.S. Andrews and R.G. Halfacre. 1995. Fundamentals of Horticulture. Tata McGraw Hill Pub. New Delhi, India.
 Georges, B., M. K. Jean and M.S. Roy. 1991. The Physiology of Flowering. CRC Press, USA.
 Nagg, S. and P.E. Shaw. 1980. Tropical and Sub-tropical Fruits; Composition, Properties and Uses. USA.
 Rao, K.M. 1995. Textbook of Horticulture. Macmillan India Ltd.
 Rao, V.N.M. 1998. Mango. ICAR, India.
 Reddy G.S and M..S. Murti. 1996. Citrus: Diseases and Their Control. ICAR, India.
 Ryugo. K. 1988. Fruit Culture, its Science and Arts. John Wiley & Sons, NY
 Salaria A.S. 1999. Horticulture at a Glance, Jain Bros. New Delhi, India.
 Samson, J. A. 1986. Tropical Fruits. Longman Group UK Ltd.
 Singh R.N. 1996. Mango, ICAR, India.
 Singh, A. 1990. Fruit Physiology and Production. New Delhi, India.
 Srivastava, RP. 1997. Management of Mango. Int. Book Distribution Co. UP, India.
 Srivastava, R.P. 1997. Mango: Insect Pest Management. Intl. Book Distribution Co. UP, India.

Level- 4, Semester-2 (Elective)

HORT 423: Commercial Horticulture-Theory, 2 Credits, 2 hrs/wk

1. **Commercial horticulture** : Concept, importance and scope of commercial horticulture in Bangladesh, agribusiness opportunities in horticulture.
2. **Seed industry for horticultural crops**: Production of seeds of self and cross pollinated crops, hybrid seed production and seedlessness, seed storage, technology and marketing.
3. **Export oriented production of horticultural crops**: French bean, mushroom, cashew nut, asparagus, bamboo shoot, baby corn, orchids, bonsai, cacti and cut flowers.
4. **Value added horticultural products** : Preparation of juice, jam, jelly, pickles and sauce; chemicals used as additives for colour, flavour, vitamins and minerals.
4. **Year round production of horticultural crops** : Special management practices, use of growth regulators, crop production under controlled condition and polytunnel.

5. **Organic farming:** Concept, importance, scope of organic farming, production of crops using organic manures, pest control using plant extracts and biological means.
7. **Self employment through horticulture :** Seedling and sapling raising, T-budding in rose, grafting in mango, patch and ring budding in jujube, flower shop and market development, production of quick growing fruits.

HORT 424:Commercial Horticulture-Practical, 2 Credits, 3 hrs/wk

1. Sterilization of soil and growing media of nursery bed.
2. Demonstration of mist-house, fog house, poly-tunnel.
3. Preparation and use of growth regulators for commercial use in horticulture.
4. Lifting and packaging of mother plants and saplings.
5. Different methods of packaging and preservation of seeds.
6. Preparation of dry flowers.
7. Cut flower packaging and flower arrangement.
8. Growing of mushroom, asparagus, orchids.
9. Techniques of hybrid seed production-flower characters, emasculation, control of cross pollination and artificial pollination.
10. Growing of vegetables through organic farming.
11. Orientation for farm management.

Text and Reference Books

- Bose, T.K. and L.P. Yadav. 1989. Commercial Flowers. Naya Prakash, Calcutta.
 MacMillan, H.E. 1962. Tropical Planting and Gardening. MacMillan, London.
 Rashid, M.M. 1990. Phuler Chas. Bangla Academy, Dhaka.
 Anonymous. 1995. Fruit and Vegetables. Post-harvest Management and Marketing.Hort. Res. & Dev. Project, FAO/UNDP, DAE/BADC, Dhaka.
 Hussain, M.M. 1995. Seed Production and Storage Technology. Meer Imtiaz Hossain,Dhaka.
 Rashid, M.A. and D.P. Singh. 2000. A Manual on Vegetable Seed Production in Bangladesh. AVROC-USAID-Bangladesh Project, BARI, Joydebpur.
 Rashid, M.M. 1999. Shabji Biggyan. 2nd ed., Rashid Pub. House, Dhaka.

DEPARTMENT OF PLANT PATHOLOGY

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Title	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
PPATH 221: Fundamentals of Plant Pathology- Theory	3 cr	3 hrs	L-2	S-2
PPATH 222: Fundamentals of Plant Pathology- Practical	2 cr	3 hrs	"	"
PPATH 321: Principles of Plant Pathology & Diseases of Field Crops-Theory	3 cr	3 hrs	L-3	S-2
PPATH 322: Principles of Plant Pathology & Diseases of Field Crops –Practical	2 cr	3 hrs	"	"
PPATH 411: Diseases of fruits, Vegetables, Cash Crops, Agro-forest Trees and Seed Pathology-Theory	3 cr	3 hrs	L-4	S-1
PPATH 412: Diseases of fruits, Vegetables, Cash Crops, Agro-forest Trees and Seed Pathology- Practical	2 cr	3 hrs	"	"
Elective:				
PPATH 421: Plant Disease Management- Theory	2 cr	3 hrs	L-4	S-2
PPATH 422: Plant Disease Clinic- Practical	2 cr	3 hrs	"	"

Level-4, Semester-1

PPATH 411: Diseases of fruits, Vegetables, Cash Crops, Agro-forest Trees and Seed Pathology- Theory, 3 Credits, 3 hrs/wk

Diseases of Fruits: Mango, banana, papaya, coconut, pineapple, jackfruit, citrus and guava.

Diseases of Vegetables: Potato, tomato, sweet potato, cabbage, cauliflower, chilli, brinjal, lady's finger, amaranth, cucurbits and beans.

Diseases of cash crops: Tobacco, tea, betelnut, betelvine, turmeric, ginger, onion & garlic.

Nursery diseases: Diseases of agroforest trees. Root rots, dieback, wilts and cankers of important forest trees.

Introduction to Seed Pathology: Importance of Seed-borne diseases in Bangladesh, significance & mechanism of transmission of pathogens, seed health testing methods, parasites of seed-borne diseases.

Assessment of Crop loss owing to plant diseases.

PPATH 412: Diseases of fruits, Vegetables, Cash Crops, Agro-forest Trees and Seed Pathology -Practical, 2 Credits, 3 hrs/wk

Methods of Collection and Preservation of diseased plant-materials.

Preparation of herbarium of diseased specimen of important crops.

Field and Laboratory studies of plant diseases.

(a) Detailed study of the following diseases:

- i. Late blight and Early blight of potato and tomato
- ii. Anthracnose of Chilli, okra, Guava and Amaranth.
- iii. Fruit rot of chilli
- iv. Alternaria leaf spot of Cabbage.
- v. Alternaria leaf spot and stemphylium blight of onion.
- vi. Powdery and downy mildew of cucurbits.
- vii. Rhizopus fruit rot of Jackfruit and kul.
- viii. Brown spot and Frog-eye leaf spot of Tobacco.
- ix. Anthracnose and Taphrina leaf spot of Turmeric.
- x. Anthracnose and leaf spot of Betelvine.

(b) Brief study of the following diseases:

- i. Dry rot, Hollow heart, Black heart and Scab of potato.
- ii. Yellow vein mosaic of okra, little leaf and fruit rot of brinjal.
- iii. Anthracnose, stem end rot and malformation of mango.
- iv. Bud rot and leaf spot of coconut
- v. Leaf spot, Wilt, Bunchy top, Anthracnose and fruit rot of banana.
- vi. Anthracnose, Stem end rot and mosaic of Papaya.
- vii. Wilt of guava
- viii. Scab, Canker, Die back and greening of lemon.
- ix. Tobacco mosaic.
- x. Blister blight and Grey blight of tea.
- xi. Foot rot and Leaf rot of betelvine.
- xii. Phanerogamic parasites (Cuscuta, Loranthus and Orobanche).
- xiii. Damping-off and seedling blight.

Seed health testing: Dry inspection, Incubation methods (Blotter and agar plate methods) and Growing on test.

Chemical Control

- a) Handling of plant protection equipments.
- b) Preparation and application of foliar fungicides. Calculation of its concentration, percentage of active ingredients, and rates of application.
- c) Students in groups are required to conduct a spray experiment with foliar fungicides for controlling specific foliar diseases of a crop.
- d) Seed and soil treatment.
- e) Prescription for control of some important diseases.

Field excursion for plant disease study.

Each student is required to submit a comprehensive report on the prepared herbarium, spray experiment and field excursion.

Text and Reference Books

Anderson, H. N. 1979. Diseases of fruit crop. McGraw Hill Book Co.

Pathak, V. N. 1986. Diseases of Fruit Crops. Published by Mohan Pramlani, Oxford & IBH Publishing Co., Janpath, New Delhi 110001.

Ranaswami, G. 1972. Diseases of Crop Plants in India. Prentice Hall of India Private Ltd.

Singh, R. S. 1987. Diseases of Vegetable Crops. Oxford & IBH Publishing Co. Pvt., Ltd. New Delhi., Bombay,

Boyce, J. S. 1961. Forest Pathology. 3rd ed. McGraw Hill Book Co.

Ashrafuzzaman, M. H. 1976. 1st ed. Laboratory Manual of Plant Pathology. Department of Plant Pathology

Barnett, H. L. 1960. Illustrated Genera of Imperfect Fungi. Burgess Publishing Company.

Chester, K. S. 1941. Nature and Prevention of plant diseases. Blakiston.

Fergus, C. L. 1966. Illustrated Genera of Wood Decay Fungi. Burgess Publishing Company.

Fulton, J. P., D. A. Slack, N. D. Fulton, J. L. Dale, M. J. Eoodeand and G. E. Templeton. 1965. Plant Pathology Laboratory Manual. Burgess Publishing Company.

Meah, M. B. and A. A. Khan. 1985. Check list of Fruit and Vegetable diseases in Bangladesh. Dept. of Plant Pathology, Bangladesh Agricultural University, Mymensingh.

Meah, M. B. and A. A. Khan. Mango diseases, Dept. of Plant Pathology. Bangladesh Agricultural University,

Singh, R. S. 1973. Plant Diseases. 3rd ed. Oxford & IBH Publishing Co.
Stakman, F. C. and J. G. Harrar, 1957. Principles of Plant Pathology. The Ronald Press Company.
Walker, J. C. 1952. Diseases of Vegetable Crops. McGraw Hill Book Co.
Walker, J. C. 1957. Plant Pathology. McGraw Hill Book Company.
Wheller B. E. J. 1969. An Introduction to Plant Diseases. John Wiley and Sons. Ltd.

Level-4, Semester-2 (Elective)

PPATH 421: Plant Disease Management- Theory, 2 Credits, 3 hrs/wk

Field visit and plant disease diagnosis
Soil treatment
Seed treatment
Seed bed preparation and raising of healthy seedlings
Field plot experiment for raising healthy crop
Post harvest practices for crops and seeds for disease management
Cost benefit analysis
Photography

Text and Reference Books

George N. Agios. Plant Pathology 4th Edition 1997. HACOURT ASIA PTE LTD.583 Orchard Road #09-01 Forum, Singapore 238884 Printed in India at Replika Press Pvt. Ltd. Delhi 110040
The Compendia of plant Disease Series : Rice Diseases (ISBN 0-89054-126-4), Wheat Diseases (ISBN 0-89054-076-4), Tomato Diseases (ISBN 0-89054-120-5), Potato Diseases (ISBN 0-89054-027-6), Barley Diseases (ISBN 0-89054-047-0), Citrus Diseases (ISBN 0-89054-092-6), Corn Diseases (ISBN 0-89054-029-2), Cotton Diseases (ISBN 0-89054-031-4), Soybean Diseases (ISBN 0-89054-126-4), Peanut Diseases (ISBN 0-89054-055-1), Pea Diseases (ISBN 0-89054-060-8), Sweet Potato Diseases (ISBN 0-89054-115-5), and Ornamental Foliage Plant (ISBN 0-89054-077-2). APS Press The American Phytopathological Society 3340 Pilot Knob Road St. Paul, MN 55121-2097 USA.
R.S. Mehrotra. Plant Pathology. Tata McGraw-Hill Publishing Company Limited, New Delhi, India
R.A. Lelliott and D.E. Stead. Methods for the Diagnosis of Bacterial Diseases of Plants.
British Society for Plant Pathology by Blackwell Scientific Publications
G. Rangaswami. Diseases of Crop Plants in India. Prentice Hall of India Private Limited
R.S. Singh. Plant Diseases 3rd Edition. Oxford & IBH publishing Co. New Delhi
C.J. Alexopoulos and E.S. Beneke. Laboratory Manual for Introductory Mycology. Bargees Publishing Co.
M.H. Ashrafuzzaman. Laboratory Manual for Plant Pathology. Department of Plant Pathology, BAU, Mymensingh – 2202.
N.W. Shcaad. Laboratory Guide for Identification of Plant Pathogenic Bacteria. Bacteriological Committee of American Phytopathological Society, St. Paul, Minnesota
I.H. Mian. Methods in Plant Pathology. IPSA – JICA Project 1995. Institute of Post Graduate Studies in Agriculture, Gazipur, Bangladesh.
A.B.A.M. Baudoin. 1990. Laboratory Exercises in Plant Pathology : An Instructional Kit. American Phytopathological Society Scientific Publishers. Ratanada Road. P.O. Box 91. Jodhpur-342001. India.

PPATH 422: Plant Disease Clinic-Practical, 2 Credits, 3 hrs/wk

Calibration and care of clinical equipments
Registration of diseased specimen
Microscopic examination of diseased specimen.
Isolation and identification of causal agents.
Preservation of diseased plant specimens.
Purification and preservation of isolated plant pathogens.
Preparation of diseased sample and isolated organism (s) for mailing.
Writing prescriptions.
Photography.

Text and Reference Books

J.M. Walker, B.J. Ritchie and M. Holderness. Plant Clinic Handbook. IMI Technical Hand Books no.3. An Institute of CAB International.
Harold E. Moline. Edited by Harold E. Moline. Post Harvest Pathology of Fruits and Vegetables: Post Harvest Losses in Perishable Crops. Publication NE-87 (UC Bulletin 1914)
Common Wealth Mycological Society. Plant Pathologist Pocket Book 2nd Edition. CMI, Kew, Surrey, England

DEPARTMENT OF CROP BOTANY

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Titles	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
CBOT 211: Plant Morphology, Embryology and Taxonomy-Theory	3 cr	3 hrs	L-2	S-1
CBOT 212: Plant Morphology, Embryology and Taxonomy-Practical	2 cr	3 hrs	"	"
CBOT 321: Plant Physiology & Ecology(I)-Theory	2 cr	2 hrs	L-3	S-2
CBOT 322: Plant Physiology & Ecology(I)-Practical	2 cr	3 hrs	"	"
CBOT 411: Plant Physiology and Ecology(II)-Theory	3 cr	3 hrs	L-4	S-1
CBOT 412: Plant Physiology and Ecology(II)-Practical	2 cr	3 hrs	"	"
Elective:				
CBOT 421: Crop Physiology-Theory	2 cr	2 hrs	L-4	S-2
CBOT 422: Crop Physiology-Practical	2 cr	3 hrs	"	"
CBOT 423: Plant Biodiversity & Conservation-Theory	2 cr	2 hrs	L-4	S-2
CBOT 424: Plant Biodiversity & Conservation- Practical	2 cr	3 hrs	"	"

Level-4, Semester-1

CBOT 411: Plant Physiology and Ecology(II)- Theory, 3 Credits, 3 hrs/wk

A. PLANT PHYSIOLOGY

Carbon fixation by crop canopies: Canopy structure, leaf area index and dry matter (DM) production, strategies for maximizing solar energy utilization.

Transport and partitioning of assimilates: Nature of solution in phloem transport, mechanism, phloem loading and unloading, source-sink relationships, assimilate partitioning and harvest index.

Growth regulators: Classification, effects of phytohormones (auxins, gibberellins, cytokinins and others) on growth and development in field and *in vitro* plants.

Seeds and germination: Structure and chemical composition, sources of assimilate and maturation, stored seed reserves and its control; dormancy- causes, releases and its significance.

Growth and development: Concept, factors affecting growth, determinate and indeterminate growth, growth correlation and growth dynamics, vegetative and reproductive growth, plant growth and yield analyses techniques.

Flowering and fruiting: Transition to flowering, photoperiodism, thermoperiodism, flower induction, minimum age, photoinductive cycles, night breaks, factor modifying photoinduction, fruiting- fruitset, seed growth and ripening.

Stress physiology: Types, nature of injury, causes, mechanisms and survival measures to overcome.

B. PLANT ECOLOGY

Ecosystems: Structures, components, functions of natural and cultivated ecosystems, energy and its flow, nutrient cycles.

Plant succession: Causes, formation of vegetation, process and types- hydrosere, xerosere, lithosere, psamosere.

Phytogeography: Principles, major vegetation regions of Bangladesh and World, agro-ecological zones (AEZ) of Bangladesh and crop suitability.

Ecology of some important crops: Rice, wheat, sugarcane, jute, cotton, tea, tobacco, important vegetables, fruits, pulses and oils.

Halophytes and Mangrove vegetation: Concept, distribution, characters, succession in coast.

Plant diversity and conservation: Concept, causes of diversity losses, methods of conservation and management, and national conservation policy (NCP).

Biotic relation: Types, interrelationship among biotic factors, vegetation and crop production, principles of crop-weed association.

Micro- and macro-environment: Concept, components, microclimate manipulation and improvement of crop production.

Environmental pollution: Types, causes, atmospheric gases, green house effects- causes and remedies, effects and control of environmental pollution.

CBOT 412: Plant Physiology and Ecology(II)- Practical, 2 Credits, 3 hrs/wk

A. PHYSIOLOGY:

- a) Demonstration of crop research in the Field Laboratory of Crop Botany Department
- b) Estimation of dry matter (DM) production, leaf area (LA), leaf area index (LAI), light interception measurement.
- c) Techniques of crop growth and yield analysis.
- d) Experiments on ecophysiological aspects of imbibition and germination of seeds, methods of breaking seed dormancy.
- e) Demonstration of the effects of different stresses on growth and yield in crops.
- f) Demonstration of the effects of different PGRs on growth and yield in crops.

B. ECOLOGY:

- a) Study of biotically related plants.
- b) Methods of ecological survey of plant communities and field study of plant habitats.
- c) Experiments on flow of energy in agro-ecosystem on light, heat transfer and radiant energy.
- d) Experiments on crop-weed association and mulches, and their effects on crop production.
- e) Ecophysiological aspects of data collection and interpretation.

Text and Reference Books

- Ambasht, R.S. and Ambasht, P.K. 1999. Environment and pollution. 3rd ed. CBS Pub., New Delhi.
- Bewley, J.D. and Black, M. 1994. Seeds: Physiology of development and germination. 2nd ed. Plenum Press, New York.
- Deshmukh, I. 1986. Ecology and tropical biology. Blackwell, Oxford.
- Dimond, J. and Case, T.J. 1980. Community ecology, Harper & Row, New York.
- Fosket, D.E. 1994. Plant growth and development. Academic Press Inc. California.
- Gardner, F.P., Pearce, R.B. and Mitchell, R.L. 1985. Physiology of crop plants. Iowa State Univ. Press, USA.
- Goldsworthy, P.R. and Fisher, N.M. 1984. The physiology of tropical field crops. John Wiley, New York.
- Hall, D.O., Scurlock, J.M.O., Bolhar-Nordenkamp, H.R., Leegood, R.C. and Long, S.P. 1993. Photosynthesis and production in a changing environment: A field and laboratory manual. Chapman and Hall, U.K.
- Hunt, R. 1982. Plant growth curves: The functional approach to plant growth analysis. Edward Arnold, London.
- Kumar, H.D. 1995. General ecology. Vikas Pub. House, New Delhi.
- Levit, J. 1980. Response of plants to environmental stresses, Academic Press, New York.
- McDonald, M.B. and Copeland, L.O. 1989. Seed science and technology: Laboratory manual. Iowa State Univ. Press, USA.
- Odum, E.P. 1971. Fundamentals of ecology. Saunders, Philadel.
- Pandey, S.N. and Sinha, B.K. 1986. Plant Physiology. Vikas Pub. House Pvt. Ltd., New Delhi.
- Salisbury, F.B. and Ross, C.W. 1986. Plant physiology. Wadsworth Pub. Co., USA.
- UNESCO. 1987. Mangroves of the asia and pacific: status and management, technical report of the UNDP/UNESCO research and training pilot programme on mangrove ecosystems in asia and the pacific. UNESCO, Paris.
- Wilson, O.E. 1988. Biodiversity. Nat. Acad. Press, Washington, DC.

Level-4, Semester-2 (Elective)

CBOT 421: Crop Physiology-Theory, 2 Credits, 2 hrs/wk

Introduction: Objective, energy relation and production factors.

Physiological basis of crop yield: Limiting process- source or sink, canopy structure, photosynthesis and biomass production, crop respiration, partitioning of assimilates, storage capacity as a limitation on yield.

Physiology of rice, wheat, sugarcane, maize, potato, jute, important oils, pulses and other crops.

Plant growth analysis: Concept, classical and functional approaches, technique of measurement, their merits and demerits.

Seed physiology: Formation and development, physiological maturity, dormancy and priming, and control of germination, importance of seed in agro-industry.

CBOT 422: Crop Physiology-Practical, 2 Credits, 3 hrs/wk

1. **Measurement of plant biomass:** Measurement of above ground and below ground biomass, non-destructive measurement of biomass, estimation of net primary production.
2. **Plant growth analysis (PGA):** Concept of PGA, classical approach, functional approach in practice, choice of functions, fitted curves.
3. **Physiological maturity (PM):** Concept, determination of PM in cereals, legumes and other crops, seed viability and PM

4. Assignment

Text and Reference Books

- Bewley, J.D. and Black, M. 1994. Seeds: Physiology of development and germination. 2nd ed., Plenum Press, New York.
- Evans, L.T. 1975. Crop physiology: some case histories. Cambridge Univ. Press, Cambridge.
- Hall, D.O., Scurlock, J.M.O., Bolhar-Nordenkamp, H.R., Leegood, R.C. and Long, S.P. 1995. Photosynthesis and production in a changing environment: A field and laboratory manual. Chapman and Hall, New York.
- Hunts, R. 1982. Plant growth curves: The functional approach to plant growth analysis. Edward Arnold, London.
- Squire, G.R. 1990. The physiology of tropical crop production. CAB International, Oxon., U.K.
- Yoshida, T. 1987. Rice crop science, IRRI, Philippines.

Level-4, Semester-2 (Elective)

CBOT 423: Plant Biodiversity and Conservation-Theory, 2 Credits, 2 hrs/wk

The nature and value of plant biodiversity: Nature, importance and types of biological diversity, direct and indirect values of biological resources.

Biodiversity loss and causes: Dimension of the loss of agricultural and forest biodiversity, principal causes of biodiversity losses, threats from the loss of plant species. IUCN Red list of plant species.

Conservation strategy: National strategy for *in situ* and *ex situ* conservation of agricultural and forest biodiversity. Conservation of rare and important wild plant genetic resources in protected areas and in different farming systems.

Biodiversity indicators: Indicators for measuring diversity, indicators of wild species and genetic diversity, community diversity and domesticated species diversity.

Plant products and uses: Resource assessment, uses, domestication and commercialization of timber and non-timber forest products.

Plant exploration and germplasm collection: Germplasm exploration, collection, conservation, evaluation and utilization.

CBOT 424: Plant Biodiversity and Conservation- Practical, 2Credits, 3 hrs/wk

1. Principles and procedures of plant collection, documentation and data management
2. Preparation of monographs on important and rare plant genetic resources (medicinal and aromatics, bamboo, rattan, fruit and nuts, spices, timber plant species).
3. Field visit to different *in situ* and *ex situ* conservation areas in Bangladesh
4. Assignment

Text and Reference Books

- 1997 United Nations List of Protected Areas. 1998. IUCN/WCMC
- Arora, R.K. and Rao, V.R. (edited). 1995. Proceedings of the South Asia National Coordinators Meeting on Plant Genetic Resources. 10-12 January 1995. BARC, Dhaka.
- CBD. 1999. Convention on Biological Diversity- Text and Annexes. Montreal, Canada.
- FAO. 1996. Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, and the Leipzig Declaration, Rome, Italy.
- Glowka, L. *et al.* 1994. A Guide to the Convention on Biological Diversity. IUCN, Switzerland.
- Gurung, J.D. (edited). 1994. Indigenous Knowledge Systems and Biodiversity Management. Proceedings of a MacArthur Foundation, ICIMOD Seminar, 13-15 April 1994, Kathmandu, Nepal.
- Hossain, M.G, Arora, R.K. and Mathur, P.N. (edited) 1997. Plant Genetic Resources-Bangladesh Perspective. Proceedings of a National Workshop on Plant Genetic Resources, 25-29 August, 1997. BARC, Dhaka.
- Jeffrey *et al.* 1997. Conserving the World's Biological Diversity. IUCN, WRI, CI, WWF-US, the World Bank. Gland, Switzerland, and Washington, D.C.
- John Mugabe *et al.* 1997. Access to Genetic Resources- Strategies for Sharing Benefits, IUCN
- Lori Ann Thrupp. 1998. Cultivating Diversity- Agrobiodiversity and Food Security, World Resources Institute
- O. P. Pareek, Suneel Sharma and R. K. Arora. 1998. Underutilized Edible Fruits and Nuts- An inventory of Genetic Resources in Their Region of Diversity
- R.K. Arora, R. K. and V. Ramanatha. 1997. Tropical Fruits in Asia- Diversity, Maintenance, Conservation and Use, International Plant Genetic Resources.
- R.S.Paroda, R.K.Arora, 1991. Plant Genetic Resources-Conservation and Management, International Board Plant Genetic Resources, international Plant Genetic Resources.
- WRI, IUCN, UNEP, FAO, UNESCO. 1992. Global Biodiversity Strategy- Guidelines for action to save, study, and use earth's biotic wealth sustainably and equitably. Gland, Switzerland.

DEPARTMENT OF GENETICS AND PLANT BREEDING

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Title	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
GPB 221: Cytology-Theory	2 cr	2 hrs	L-2	S-2
GPB 222: Cytology-Practical	2 cr	3 hrs	"	"
GPB 311: Genetics and Cytogenetics –Theory	3 cr	3 hrs	L-3	S-1
GPB 312: Genetics –Practical	2 cr	3 hrs	"	"
GPB 421: Plant Breeding –Theory	3 cr	3 hrs	L-4	S-2
GPB 422: Plant Breeding –Practical	2 cr	3 hrs	"	"
Elective:				
GPB 411: Plant Biotechnology and Genetic Engineering –T	2 cr	2 hrs	L-4	S-1
GPB 412: Plant Biotechnology and Genetic Engineering –P	2 cr	3 hrs	"	"
GPB 423: Special Plant Breeding – Theory	2 cr	2 hrs	L-4	S-2
GPB 424: Special Plant Breeding – Practical	2 cr	3 hrs	"	"

Level-4, Semester-2

GPB 421: Plant Breeding – Theory, 3 Credits, 3 hrs/wk

1. Principle and basic topics: Scope and goal of plant breeding, mechanism of self and cross-pollinations, genetic significance of pollination methods. Evolution of crop plants, centres of origin and diversity, conservation and management of plant genetic resources.
2. Genetic basis of crop improvement: Population structure and gene frequency; effects of genes in quantitative inheritance; heritability and its role on genetic advance; hybrid vigour, inbreeding depression, male sterility and self incompatibility phenomena and their causes.
3. **General plant breeding methods:**
 - a) For self-pollinated crops - pedigree, single seed descent, bulk population and backcross methods.
 - b) For cross-pollinated crops - mass selection, recurrent selection, development of hybrid and synthetic varieties.
 - c) For vegetatively propagated crops - clonal selection after hybridization, mutation and polyploidization.
4. **Special plant breeding methods:**
 - a) Heterosis breeding - types and measurement of heterosis, commercial exploitation, techniques of hybrid seed production.
 - b) Mutation breeding - induction and utilization of mutants in crop improvement.
 - c) Polyploid breeding - induction and use of auto and allo-polyploids.
 - d) Resistance breeding - for disease and insect.
 - e) Stress breeding - for important stress factors.
5. **Innovative methods:**
Application of biotechnology and genetic engineering in crop improvement:
 - a) Tissue culture – cellular totipotency, micropropagation, embryo culture, anther culture, pollen culture, somatic embryogenesis and somatic hybridization (protoplast fusion).
 - b) Recombinant DNA technology - cloning and selection of recombinants.
6. **Variety release and seed production:** Principles and practices relating to evaluation and release of new crop varieties, seed legislation, seed certification and seed testing.

GPB 422: Plant Breeding- Practical, 2 Credits, 3 hrs/wk

1. **Hybridization techniques:**
Floral biology, pollination system and crossing techniques in crop plants, such as rice, wheat maize, tomato, beans, peas, groundnut, mustard and jute.
2. **Demonstration of field experiments:**
 - a) Demonstration of parental, hybrid and segregating populations and data collection.
 - b) Demonstration of breeding research activities in the GPB experimental farm.
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. **Tissue Culture:** Preparation of tissue culture media, sterilization techniques and handling of equipment related to tissue culture, and demonstration of embryo culture.

Text and Reference Books

- Old, R. W. and Primrose, S. B. 1994. Principles of Gene Manipulation- An introduction to Genetic Engineering. Blackwell Scientific Publications. London. 5th edition.
- Poehlman, J. M. and Sleeper, D. A. 1995. Breeding Field crops. Panima Pub. Cor. , New Delhi.
- Sharma, J. R. 1994. Principles and Practice of Plant Breeding. Tata McGrawHill Pub, New Delhi.
- Singh , B. D. 1986. Plant Breeding. Kalyani Publishers, India.
- Allard , R.W. 1960. Principles of Plant Breeding. John Wiley and Sons, Inc. New York.
- Bhojwani, S. S. and Razdan, M. K. 1983. Plant Tissue Culture : Theory and Practice. Elsevier Science Pub. Amsterdam.
- Bhuiya, M. S.R. 1999. Udvid Projanan. 2nd edn. Bangla Academy, Dhaka (In Bangla).
- Chopra , V. L. 1989. Plant Breeding : Theory and Practices. Oxford and IBH Pub. , New Delhi.
- Chopra, V. L. and Nasim, A. 1990. Genetic Engineering and Biotechnology. Oxford and IBH Pub. , New Delhi.
- David , W. R. 1995. Pollination of Cultivated Plants in the Tropics. FAO, Rome.
- Falconer, D.S. and Mackay , T. F. C. 1996. Introduction to Quantitative Genetics. Longman Essex, UK.
- Ferhr, W.R. and Hadley, H.H. 1980. Hybridization in crop plants. American Soc. Agron. & Crop Sci. Soc. America, Madison.
- Gamborg, O. L. and Phillips , G. C. 1995. Plant cell, tissue and organ culture, Fundamental methods. Narosa Pub. House, New Delhi.
- IPGRI. 2000. Cryopreservation of Tropical Plant Germplasm - Current Research Progress and Application. Florent Engelmann and Hiroko. Takagi, Rome.
- Islam, M. A. 1998. Udvid Projanan. Private Pub. , BAU, Mymensingh (In Bangla)
- Primrose, S. B. 1987. Modern Biotechnology. Backwell Scientific Pub. , London

Level –4, Semester –1 (Elective)

GPB 411: Plant Biotechnology and Genetic Engineering-Theory, 2 Credits, 2 hrs/wk

Biotechnology:

1. Concepts and basic techniques in tissue culture, prerequisites for cell and tissue culture, media preparation and sterilization techniques.
2. Anther culture: Production of haploids and double haploids and their application in agriculture.
3. Plant regeneration from callus & cell suspension cultures by somatic embryogenesis :
4. Somaclonal & gametoclonal variation: Concepts and practical application of variability in tissue cultures.
5. Protoplast isolation, fusion and culture: Somatic hybridization, selection system of hybrid and production of hybrids.
Role of protoplast culture and somatic hybrids in the development of crop plants.

Genetic engineering:

6. Basic principles of recombinant DNA technology
7. Cloning – concept and basic steps; application of bacteria and viruses in genetic engineering, cloning vectors, expression of cloned genes, selection of recombinants.
8. Restriction endonucleases and their nomenclature.
9. Genetic transformation in crop plants: Concept, various methods of gene transfer, Agrobacterium –mediated transformation for disease resistance.
10. PCR- Concept and application in gene cloning
11. Application of recombinant DNA technology in crop improvement.

GPB 412: Plant Biotechnology and Genetic Engineering - Practical, 2 credits, 3 hrs/wk

1. Prerequisites for an ideal tissue culture laboratory
2. Media preparation
3. Preparation of explants
4. Sterilization of media and explants.
5. Extraction of DNA from leaf samples.
6. Agarose gel electrophoresis for DNA isolation.
7. Agrobacterium-mediated transformation techniques: Plating of Agrobacterium with plasmids, co-cultivation of explants

Text and Reference Books

- Dixon, R. A. 1987. Plant cell culture: a practical approach IRL Press. Oxford, Washington DC.
- Razdan, M. K. 2000. An introduction to Plant tissue culture oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.
- Brown, T. A. 2002. Gene cloning and DNA analysis: An introduction 4th edition. Blackwell science
- Gamborg, O. L. and Phillips, G. C. 1995. Plant cell, tissue and organ culture, Fundamental methods. Narosa Pub. House, New Delhi, Bombay, Loud, Madras, Calcutta.
- Old, R. W. and Primrose, S. B. 1994. Principles of Gene Manipulation- An introduction to Genetic Engineering. Blackwell Scientific Publications. London. 5th edition.
- Ignacimuthu, S.S. J. 1998. Plant Biotechnology IBH. Pub. Co. Pvt. Oxford.
- Jane, K. ; Setlow and Alexander , H. 1982. Genetics engineering . Principles and methods. Plenum Press, New York.
- Michael , W. F. , Graham, S. W. And young , M. M. 1992. Plant Biotechnology Perogamon Press, Tokyo, Seoul, Newyork, Oxford.
- Moss, J. P. 1992. Biotechnology and crop improvement in Asia. Andraprodesh ICRISAT, India
- Application of Plant *in vitro* technology. 1993. Malaysian Biochemical society.
- Primrose, S. B. 1987. Modern Biotechnology. Blackwell Scientific Publications, London.
- Proceeding of the International Symposium, 1993. Applications of plant *in vitro* technology. Malaysia, 16-18 Nov. 1993.
- Raymond , L. ; Rodriguoz and Robert, C. Tait. 1983. Recombinant DNA techniques - An introduction. The Benjamin/ cummings Publishing Co. London.
- Robert , J. 1987. Tissue culture of selected tropical fruit plants ; a hand book on the application of tissue culture of plant propagation. FAO, Rome.

Level- 4, Semester –2 (Elective)

GPB 423: Special Plant Breeding -Theory, 2 credits, 2 hrs/wk

1. Status of breeding achievements of important field crops in Bangladesh: rice, wheat, maize, jute, sugarcane, mustard, groundnut, soybean, lentil, chickpea and tomato.
2. Breeding for hybrid variety in self –pollinated crops: System of pollination control. Development, selection, and maintenance of parental lines, production of single cross and double cross hybrids, significance and problems.
3. Mutation in crop improvement: Handling of mutagenized materials, factors influencing mutation spectrum, prospects and limitation of mutation breeding.
4. Polyploid in crop improvement: Polyploids in nature, artificial induction of polyploids, its application in crop improvement, prospects and limitations of polyploid breeding.
5. Haploidy in crop improvements: Haploids in nature, induction of haploids and doubled haploids, their application in crop improvement, prospects and limitations.
6. Wide hybridization: Objectives, barriers, application in crop improvement-alien addition, alien substitution and transfer of segment of chromosomes, transfer of cytoplasm, prospects and limitations.
7. Apomixis: Origin induction and its application in crop improvement.
8. Quality seed: Classes, production practices and maintenance of breeders' seeds.
9. Plant Breeders' rights: Requirements, farmer's privilege, breeders' exemption, benefits and disadvantages from PBR.

GPB 424: Special Plant Breeding – Practical, 2 credits, 3 hrs/wk

1. Demonstration of mutants, polyploids and hybrids in research fields.
2. Haploid production through anther culture and wide crossing.
3. Interspecific hybridization.
4. Polyploid production
5. Evaluation and maintenance of parental lines in hybrid seed production.
6. Study visit at different crop breeding stations followed by report.

Text and Reference Books

- Sharma, J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw-Hill Publishing Company, New Delhi, India.
- Singh, B.D. 2000. Plant Breeding, Kalyani Publishers, New Delhi, India.
- Van der Have, D.J. 1979. Plant Breeding Perspectives. Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands.
- Bhuiya, M.S. R. 1999. Udvig Projonon. 2nd edn. Bangla Academy, Dhaka (In Bangla)
- Chopra, V. L. 1985(ed.). Genetic manipulation for crop Improvement. Oxford IBH Publishing Co. New Delhi.
- Chopra, V.L. 1989. Plant Breeding : Theory and Practices Oxford and IBH Pub, New Delhi.
- Fehr, W.R. and H.H. Hadley. 1980. Hybridization in Crop Plants. American Society of Agronomy and Crop Science Society of America, Madisan, USA.

Virmani, S. S. 1994(ed.). Hybrid Rice Technology: new developments and future prospects. International Rice Research Institute, Philippines.

DEPARTMENT OF AGRICULTURAL EXTENSION EDUCATION

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Titles	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
AGEXT 221: Fundamentals of Extension, Leadership and Motivation-Theory	3 cr	3 hrs	L-2	S-2
AGEXT 222: Extension Teaching Methods and Aids-Practical	2 cr	3 hrs	"	"
AGEXT 311: Extension Communication and Group Approaches-Theory	2 cr	2 hrs	L-3	S-1
AGEXT 312: Data Collection, Processing and Report Writing-Practical	2 cr	3 hrs	"	"
AGEXT 411: Extension Organization Management-Theory	3 cr	3 hrs	L-4	S-1
AGEXT 412: Extension Programme Planning and Outreach Programme-Practical	2 cr	3 hrs	"	"
Elective:				
AGEXT 413: Extension for Sustainable Agricultural Development Theory	2 cr	2 hrs	L-4	S-1
AGEXT 414: Extension for Sustainable Agriculture Development – Practical	2 cr	3 hrs	"	"
AGEXT 421: Community Participation-Theory	2 cr	2 hrs	L-4	S-2
AGEXT 422: Community Participation-Practical	2 cr	3 hrs	"	"

Level-4, Semester-1

AGEXT 411: Extension Organization Management-Theory, 3 Credits, 3 hrs/wk

Extension organization : Concept of organization and extension organization; objectives and features of an extension organization, classification of extension organizations in Bangladesh; qualifications and duties of an extension administrators, specialists, supervisors and field workers.

Management functions in organization : Concept of management function; elements of management; management problems of an organisation.

Human Resources Development: Different techniques of human resources development; training and its importance and types; methods of identification of training needs.

Decision-making process in extension organization : Concept of decision-making; steps in decision-making; factors affecting decision-making; constraints in decision making in organisations.

Extension programme planning : Concept of programme and extension programme planning; importance, principles and steps of extension programme planning

Monitoring and evaluation of extension programme : Meaning and types of monitoring; importance of monitoring in extension programmes; meaning, types, principles and steps in evaluation of extension programmes.

Rural youth : Youth, youthhood and rural youth; roles of youths; youth programmes in Bangladesh; rural youths in agricultural extension programmes and activities.

Rural women in agriculture: Role of rural women in agricultural activities; involvement of women in decision-making process in family; agricultural extension work for income generation and empowerment of women in Bangladesh.

Landless farmers : Concepts of landlessness; socio-economic situation of landless rural families; suitable agricultural activities and interest of landless families.

AGEXT 412: Extension Programme Planning and Outreach Programme-Practical, 2 Credits, 3hrs/wk

1. **Problem identification :** Identification of farmers' problems through using participatory methods; conduction of problem census for problem identification.
2. **Problem and objective analysis:** Different categories of problems and objectives; preparation of appropriate problem chart/tree and objective chart/tree and stakeholder analysis.
3. **Alternative analysis:** Procedure for alternative analysis; preparation of alternative analysis/chart.
4. **Logical framework of an extension programme :** Preparation of a logical framework.
5. **Plan of work and calendar of work :** Preparation of a plan of work and a calendar of work.
6. **Training :** Preparation of a training schedule; management of training activities

7. **Visit to agricultural farms/organization** : Visit to an agricultural organisation/farm visit and preparation of report.
8. **Extension field trip** : Conduction of an extension field trip and submission of report.

Text and Reference Books

- Bhuiya, M.H. and M.A.M. Miah. 1998. *Extension Psychology*. Dhaka: Krishi Lekhak Forum, Colourline Printers, Dhaka.
- Bhuiya, M.H. 1999. *Extension Organization and Management*. Dhaka: Gulshan Publications.
- Hassanullah, M. 1995. *Managing Extension Services*. Dhaka: University Press Ltd
- Kashem, M.A. 1992. *Samprasaran Bigyan* Dhaka : The Bangladesh Packing Press.
- Samanta R.K. (ed). 1993. *Extension Strategy for Agricultural Development*. New Delhi: MD Publications.
- Samanta, R.K. (ed.) 1995. *Women in Homestead The South Asian Perspective*. New Delhi: . MD Publications Ltd.
- Swanson, B. E., R.P. Bentz and A.J. Sofranko (eds) 1997. *Improving Agricultural Extension. a reference Manual*. 3rd edn. Rome: Food and Agriculture Organization of the United Nations.
- Van den Ban, A.W. and H.S. Hawkins. 1996. *Agricultural Extension*. 2nd ed. London: Blackwell Science Ltd.

Level-4, Semester-1 (Elective)

AGEXT 413: Extension for Sustainable Agricultural Development- Theory, 2 Credits, 2 hrs/wk

1. Socio-economic Impact of Modern Agriculture: Effects of chemical fertiliser, pesticides and modern practices on environment, soil and water quality; ground water use and its impact on soil and human health; salinity, alkalinity and soil degradation.
2. Sustainable Agricultural Development: Concept, criteria and elements of sustainability in agriculture.
3. Local Groups and Institutions for Sustainable Agriculture: Local groups, and their social empowerment and advocacy; formations of local groups; functions of different types of local groups towards sustainable farming and rural development.
4. Managing Practices towards Environment Friendly and Sustainable Agricultural Development:
 - i) Indigenous Technical Knowledge (ITK) (ii) Integrated Pest Management (IPM)
 - ii) Integrated Plant Nutrient Management (IPNM) (iii) Organic Farming (OF) (iv) Integrated Crop Management (ICM)
5. Facilitating Sustainable Agriculture: Research and extension agenda for sustainable agriculture.

AGEXT 414: Extension for Sustainable Agricultural Development-Practical, 2 Credits, 3 hrs/wk

1. Identification of ITKs in the rural community: Farm and home visit, Focus Group Discussion (FGD), Observation, PRA, and Surveying through semi-structured interviewing.
2. Surveying the extent of use of ITKs in the farming community in respect to crops animals, fishes.
3. Surveying the extent of use of plant products as bio-pesticides by the farmers.
4. Identification and exploring the use of medicinal plants used by the farmer in human and animal health.

Text and Reference Books

- Manion, A. M. 1995. *Agriculture and Environmental Change: Temporal and Spatial Dimensions*. New York: John Wiley & Sons.
- Pretty, J. N. 1995. *Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance*. London: Earthscan.
- Reijntes, C., B. Haverkort and A. Waters-Bayer. 1992. *Farming for the Future: An Introduction to Low-External-Input and Sustainable Agriculture*. Leusden, Netherlands: Macmillan.
- Röling, N. G. and M. A. E. Wagemakers. 1998. *Facilitating Sustainable Agriculture: Participatory Learning and Adaptive Management in Times of Environmental Uncertainty*. Cambridge: Cambridge University Press.
- Vidhuizen, L.V., A. Waters-Bayer and H. D. Zeeuw. 1997. *Developing Technology with Farmers: A Trainer's Guide for Participatory Learning*. London: ETC.

Level-4, Semester-2 (Elective)

AGEXT 421: Community Participation-Theory, 2 Credits, 2 hrs/wk

1. Community Participation — The on-going community based leading organizations in Bangladesh and their role and functions: BAUEC, BRDB, LGED, Gucha gram, BARD, BRAC, CARE, PROSHIKHA etc. The class teacher will select any two/three suitable agencies in each semester for study/observation.
2. The present community development approaches of above selected GOs and NGOs in Bangladesh and their comparative advantages and disadvantages.

- The role and functions of the field level workers of the above selected community based organizations.
- The history of comparative community development programme in Bangladesh and other Southeast Asian Countries: India, Thailand, Malaysia, Vietnam and Japan.

AGEXT 422: Community Participation-Practical, 2 Credits, 3 hrs/wk

Each student will be assigned with atleast two community based organizations — one from GO and other from NGO and write case studies/term paper as assigned by the class teacher.

Text and Reference Books

- Chitamber, J.B. 1973. *Introductory Rural Sociology* (a synopsis of concepts & principles) New Delhi: Wiley Eastern Private Ltd.
- Halim, Abdul and Kaida Yoshihiro. 2001. *Agricultural Extension in South and Southeast Asia — A Comparative Historical Review*; (Mimeo.).
- Kamath, M.G. (ed.) 1961. *Extension Education in Community*. Development Directorate of Extension. New Delhi, Ministry of Food and Agriculture, Government of India,
- Swanson, B. E., R.P. Bentz and A.J. Sofranko (eds) 1997. *Improving Agricultural Extension. a reference Manual*. 3rd edn. Rome: Food and Agriculture Organization of the United Nations.
- Updated Annual Reports and Publication of different GOs & NGOs as assigned by the class teacher. The organization should cover BRDB, DAE, LGED, BARD, BRAC, PROSHIKHA and other leading NGOs.

DEPARTMENT OF AGRICULTURAL CHEMISTRY

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Titles	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
ACHEM 221: Nuclear and Agro-industrial Chemistry –Theory	2 cr	2 hrs	L-2	S-2
ACHEM 222: Nuclear and Agro-industrial Chemistry – Practical	2 cr	3 hrs	"	"
ACHEM 311: Plant Nutrition, Pesticide and Environmental Chemistry – Theory	3 cr	3 hrs	L-3	S-1
ACHEM 312: Plant Nutrition, Pesticide and Environmental Chemistry – Practical	2 cr	3 hrs	"	"
Elective:				
ACHEM 411: Bioenergy – Principles & Practices – Theory	2 cr	2 hrs	L-4	S-1
ACHEM 412: Bioenergy – Principles and Practices –P	2 cr	3 hrs	"	"
ACHEM 421: Micronutrients in Agriculture-Theory	2 cr	2 hrs	L-4	S-2
ACHEM 422: Micronutrients in Agriculture-Practical	2 cr	3 hrs	"	"

Level-4, Semester-1 (Elective)

ACHEM 411: Bioenergy- Principles and Practices- Theory, 2 Credits, 2 hrs/wk

Concept, Scope and Importance of Bio-energy.

Potential Roles and Impact of Bio-energy.

Energy from biomass: Past and present perspectives of bioenergy.

Biomass Resources: a) Biomass wastes b) Energy Crops c) Aquatic sources.

Energy Profiles: a) Producer gas b) Biogas c) Hydrogen d) Ethanol e) Methanol f) Vegetable oil g) Solid fuels

Bioconversion Processes: a) Microbial conversion b) Thermal conversion c) Fuels d) Co-products

Biogas: Historical developments of biogas technology in Bangladesh. The anaerobic digestion process, digester design, primary products and by-products of biogas, utilization of biogas effluents, use of biogas.

The Role of Wood in Energy production in Bangladesh: a) Prospect and retrospect b) Description of the process c) Requirements for agricultural applications.

Energy, economics and environment: a) Energy analysis and economics of biomass b) Environmental and sociological issues.

Renewable resources of energy: Concept, Scope and Importance. Comparative feasibility of renewable energy against bioenergy in Bangladesh.

Bioremediation: Concept, scope and importance, forms of remediation, prospects of bioremediation in Bangladesh

ACHEM 412: Bioenergy- Principles and Practices- Practical, 2 Credits, 3 hrs/wk

1. Collection and preparation of various wastes.
2. Production of biogas from agrowastes.
3. Chemical analysis of cowdung and biogas effluents.
4. Analysis of domestic, municipal and industrial wastes.
5. Application of biogas effluents on field crops.

Text and Reference Books

Manahan, S.E. 1984. Environmental Chemistry. 4th edn. Brooks/Cole Publishing Company, Monterey, California.
Misra, S.G. and Mani, D. 1991. Soil Pollution. Ashish Publishing House, Punjabi Bagh, New Delhi, India.
Cheris Lewis. 1983. Biological Fuels. Studies in Biology No. 153. Energy Studies Unit, University of Strathclyde, UK.
Goteberg.1984. World Conference on Bioenergy, held on June 18-21, 1984, Sweden.
Mason, C.F. 1976. Decomposition. Studies in Biology No. 74. University of Essex, UK.
USDA Agricultural Research. 2002. Bioenergy Today. USA.
Loeppert, R. 2000. Arsenic chemistry and biology, and the management of arsenic contaminated soil and water. Treatment/ Remediation. Biological/Phytoremediation Symposium, Nov. 6-7.pp. 1-10.

Level-4, Semester-2 (Elective)

ACHEM 421: Micronutrients in Agriculture- Theory, 2 Credits, 2 hrs/wk

1. Micronutrients in soil parent materials, soils, plants and animals.
2. Geographic pattern of trace element problems and distribution of problematic areas.
3. Adsorption and desorption mechanisms and reactions of individual micronutrients.
4. Extraction and redistribution of micronutrients in soils.
5. Mechanisms of micronutrient uptake and translocation in plants.
6. Function and interactions of micronutrients in plants and soils
7. Environmental and soil factors affecting micronutrient deficiencies and toxicities.
8. Trace element analyses.
9. Fertilizer applications for correcting micronutrient deficiencies.
10. Trace element pollution.

ACHEM 422: Micronutrients in Agriculture- Practical, 2 Credits, 3 crs/ wk

1. Determination of available and total micronutrients in soil.
2. Fractionation of micronutrients in soils and assessment of the fate of applied micronutrients in soil.
3. Interpretation of soil analysis data with crop yield and micronutrient concentration and plant uptake.

Text and Reference Books

Havlin, John L., James D. Beaton, Samuel, L. Tisdale and Wernet L. Nelson. 1999. Soil Fertility and Fertilizers. Prentice Hall, New Jersey 07458.
Mortvedt, J. J., F. R. Cox, L. M. Shuman and R. M. Welch. 1991. Micronutrients in Agriculture. Soil Science Society of America, Inc. Book Series: 4. Madison, Wisconsin, USA.
Page, A. L., Miller, R. E. and Keeney, D. R. 1982. Methods of Soil Analysis, Part-2. American Society of Agronomy.
Davis, Brian, E. 1980. Applied Soil Trace Elements. John Wiley and Sons. New York.
IRRI. 1980. Standard Methods of Analysis for Soils, Plant tissue, Water and Fertilizer. Farm Resources and Systems Research Division, Los Banos, Laguna, Philippines.
Kabata-Pendias, A. and Pendias, H. 1994. Trace Elements in Soils and Plants. CRC Press, Inc.
Sprague, H.B. 1964. Hunger Sign in Crops. David McKay Company, New York.

DEPARTMENT OF BIOCHEMISTRY

Types of courses available for B.Sc.Ag. (Hons.) degree in the semester system

Course No. and Title	Credit	Contact hrs/wk	Available at	
			Level	Semester
Compulsory:				
BCHEM 121: Chemistry of Biomolecules-Theory	2 cr	2 hrs	L-1	S-2
BCHEM 122: Chemistry of Biomolecules-Practical	2 cr	3 hrs	"	"
BCHEM 211: Metabolism and Human Nutrition-Theory	3 cr	3 hrs	L-2	S-1
BCHEM 212: Metabolism and Human Nutrition-Practical	2 cr	3 hrs	"	"
Elective:				
BCHEM 411: Fundamentals of Molecular Biochemistry and Biotechnology- Theory	2 cr	2 hrs	L-4	S-1
BCHEM 412: Fundamentals of Molecular Biochemistry and Biotechnology-Practical	2 cr	3 hrs	"	"

Level-4, Semester-1 (Elective)

BCHEM 411: Fundamentals of Molecular Biochemistry and Biotechnology-Theory, 2 Credits, 2 hrs/wk

Theory : Nucleic acid as genetic material. DNA replication and transcription. Protein biosynthesis and regulation. Genetic code. Biochemistry of viruses. Immunoglobulins. Enzyme isolation, purification, mechanism of action, kinetics, regulation and immobilization. Bioregulation of carbohydrate and lipid and their accumulation in storage tissue of plant. Recombinant DNA and concept of biotechnology.

Practical : Determination of K_m and V_{max} , effect of inhibitors on K_m and V_{max} , enzyme immobilization, electrophoresis, chromatography with special to HPLC, autoradiography.

BCHEM 412: Fundamentals of Molecular Biochemistry and Biotechnology -Practical, 2 Credits, 3 hrs/wk

Cell organelles and their functions. Quantum capture and distribution. Photophosphorylation carbon reduction cycle and photorespiration. Biosynthesis of storage and structural proteins, polysaccharides, glycosides, fatty acids, membrane and storage lipids. Biochemistry of seed development and fruit ripening. Seed germination. Biological nitrogen fixation. Ureide metabolism. Sulphate reduction. Growth regulators. Secondary plant products and their role. Role of minerals in plant metabolism.

Text and Reference Books

Molecular Biology of Gene. 3rd Edition. Names D. Watson. W.A. Benjamin, Inc. 1987.
 Biochemistry and Molecular Biology, William H. Elliot and Daphne C. Elliot. Oxford University Press, 1997.
 Principles of Biochemistry, Albert L. Lehninger 2nd Edition. Kalyani Publishers. Ludhiana, New Delhi, 1994.
 Molecular Cloning: DNA Analysis. T.A. Brown. 4th Edition, 2002.
 Biochemistry. 2nd Edition. D. Voet and G. Voet. John Wiley and Sons, Inc. New York.
 An introduction to Practical Biochemistry, Davit T. Plummer, Tata McGraw-Hill Publishin Company Limited, New Delhi, 1995.
 Plant Biochemistry. J. Bonner and J.E. Verner, Academic Press, Inc. New York. 1st Edition, 1966.
 Biochemistry. Albert L. Lehninger, 2nd Edition, Kalyani Publishers. Ludhiana, New Delhi, 1982.
 Outline of Biochemistry 5/E.E. Conn., P.K. Stumpf., G. Bruening and R.H. Dol. John Wiley and Sons, Singapore, 1995.
 Pearsons Chemical Analysis of Foods. 8th Edition. H. Egan, R.S. Kirk and R. Sawyer. Longman Group Limited, 1981.
 Biochemistry. 2nd Edition. D. Voet and G. Voet. John Wiley and Sons. Inc. New York, 1995.
 Plant Biochemistry. Revised Edition. G. Doby. Interscience Publishers, 1965. London, New York, Sydney.

Level-4, Semester-1 (Elective)

ENVSC 401: Management of Environment-Theory 2 Credit

Introduction: Natural resources — soil, water, vegetation, animals (including fishes, livestock and wildlife), food, minerals and energy resources.

Biodiversity: Classification and conservation for environmental sustainability. Concept and components of Eco-park. Convention of biodiversity.

Wetlands of Bangladesh: Introduction, classification, socio-economic values, management and strategies for sustainable development.

Rural and urban environment: Components and management of rural and urban environment, population and environment.

Waste management: Importance of waste management. Types, sources and disposal of wastes. Collection, storage and transport of farm waste: livestock and poultry. Waste water treatment.

Environmental degradation: Concepts of degradation and pollution, degradation of atmosphere, hydrosphere and lithosphere, causes and impacts on Bangladesh environment and their management. Environmental pollution model.

Disaster Management: Concept, classification, management of rainfall, drought, river erosion, flood, cyclone and earthquake.

Environmental economics: Concept, utilization of resources, natural resource economics, risk-benefit analysis.

Text Books/References:

Botkin, D. B. and Keller, E. A. 1997. Environmental Science – Earth as a Living Planet. Second Edition. John & Wiley Sons, Inc. New York.

Chiras, D. D. 1985. Environmental Science – A Framework for Decision Making. The Benjamin/Cummings Publishing Company, Inc. 655p.

Critchfield, H. J. 1979. General Climatology. *Third Edition*. Prentice-Hall of India, Private Limited, New Delhi.

Greenwood, N. J. and Edwards, J. M. B. 1979. Human Environments and Natural Systems. Duxbury Press (Wadsworth Publishing Company, Inc.). 548p.

Kaufman, P. B. and LaCroix, J. D. 1979. Plants, People & Environment. Macmillan Publishing Co., Inc. 542p.

Khan, M. S. 1994. Wetlands of Bangladesh (*Edited*). Holiday Printers Limited, Dhaka.

Khuda, Z. R. M. M. 2001. Environmental Degradation – Challenges of the 21st Century. *Environmental Survey and Research Unit, Dhaka, Bangladesh*.

Miller, Jr., G. T. 1985. Living in the Environment – An Introduction to Environmental Science. Fourth Edition. Wadsworth Publishing Company. 561p.

Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadel.

Oke, T. R. 1987. Boundary Layer Climate, Second Edition. Routledge, University Press, Cambridge.

ReVelle, P. and ReVelle, C. 1981. The Environment – Issues and Choices for Society. Willard Grant Press, New York, 762p. (Edited).

Rosenberg, J. R., Blad, B. L. and Shashi, B. V. 1983. Microclimate – The Biological Environment. John Wiley & Sons.

Taiganides, E.P. 1977. Animal Waste. Applied Science Publishers Ltd, England.

Turk, A.; Turk, J.; Wittes, J. T. and Wittes, R. E. 1978. Environmental Science. Second Edition. W. B. Saunders Company.

ENVSC 402: Management of Environment-Practical 2 Credit

1. Analysis of water for pollution studies.
2. Analysis of heavy metals of soils.
3. PRA exercise and reporting on environmental related issues.
4. Survey of lifestyle of slum people.
5. Waste management activities in crop, livestock and poultry farms.
6. Soil and crop pollution practices.

Text Books/References:

Greenwood, N. J. and Edwards, J. M. B. 1979. Human Environments and Natural Systems. Duxbury Press (Wadsworth Publishing Company, Inc.). 548p.

Gaston, K. J. and Spicer J. I. 1998. Biodiversity – An Introduction. Blackwell Science.

Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadel.

Rosenberg, J. R., Blad, B. L. and Shashi, B. V. 1983. Microclimate – The Biological Environment. John Wiley & Sons.

Sutherland, W.J. 2001. The Conservation Handbook --- Research, Management and Policy. Blackwell Science Ltd.

Taiganides, E.P. 1977. Animal Waste. Applied Science Publishers Ltd, England.

Level-4, Semester-2 (Elective)

ENVSC 401: Management of Environment-Theory 2 Credit

Introduction: Natural resources — soil, water, vegetation, animals (including fishes, livestock and wildlife), food, minerals and energy resources.

Biodiversity: Classification and conservation for environmental sustainability. Concept and components of Eco-park. Convention of biodiversity.

Wetlands of Bangladesh: Introduction, classification, socio-economic values, management and strategies for sustainable development.

Rural and urban environment: Components and management of rural and urban environment, population and environment.

Waste management: Importance of waste management. Types, sources and disposal of wastes. Collection, storage and transport of farm waste: livestock and poultry. Waste water treatment.

Environmental degradation: Concepts of degradation and pollution, degradation of atmosphere, hydrosphere and lithosphere, causes and impacts on Bangladesh environment and their management. Environmental pollution model.

Disaster Management: Concept, classification, management of rainfall, drought, river erosion, flood, cyclone and earthquake.

Environmental economics: Concept, utilization of resources, natural resource economics, risk-benefit analysis.

Text Books/References:

Botkin, D. B. and Keller, E. A. 1997. Environmental Science – Earth as a Living Planet. Second Edition. John & Wiley Sons, Inc. New York.

Chiras, D. D. 1985. Environmental Science – A Framework for Decision Making. The Benjamin/Cummings Publishing Company, Inc. 655p.

Critchfield, H. J. 1979. General Climatology. *Third Edition*. Prentice-Hall of India, Private Limited, New Delhi.

Greenwood, N. J. and Edwards, J. M. B. 1979. Human Environments and Natural Systems. Duxbury Press (Wadsworth Publishing Company, Inc.). 548p.

Kaufman, P. B. and LaCroix, J. D. 1979. Plants, People & Environment. Macmillan Publishing Co., Inc. 542p.

Khan, M. S. 1994. Wetlands of Bangladesh (*Edited*). Holiday Printers Limited, Dhaka.

Khuda, Z. R. M. M. 2001. Environmental Degradation – Challenges of the 21st Century. *Environmental Survey and Research Unit, Dhaka, Bangladesh*.

Miller, Jr., G. T. 1985. Living in the Environment – An Introduction to Environmental Science. Fourth Edition. Wadsworth Publishing Company. 561p.

Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadel.

Oke, T. R. 1987. Boundary Layer Climate, Second Edition. Routledge, University Press, Cambridge.

ReVelle, P. and Revelle, C. 1981. The Environment – Issues and Choices for Society. Willard Grant Press, New York, 762p. (Edited).

Rosenberg, J. R., Blad, B. L. and Shashi, B. V. 1983. Microclimate – The Biological Environment. John Wiley & Sons.

Taiganides, E.P. 1977. Animal Waste. Applied Science Publishers Ltd, England.

Turk, A.; Turk, J.; Wittes, J. T. and Wittes, R. E. 1978. Environmental Science. Second Edition. W. B. Saunders Company.

ENVSC 402: Management of Environment-Practical 2 Credit

1. Analysis of water for pollution studies.
2. Analysis of heavy metals of soils.
6. PRA exercise and reporting on environmental related issues.
7. Survey of lifestyle of slum people.
8. Waste management activities in crop, livestock and poultry farms.
6. Soil and crop pollution practices.

Text Books/References:

Greenwood, N. J. and Edwards, J. M. B. 1979. Human Environments and Natural Systems. Duxbury Press (Wadsworth Publishing Company, Inc.). 548p.

Gaston, K. J. and Spicer J. I. 1998. Biodiversity – An Introduction. Blackwell Science.

Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadel.

Rosenberg, J. R., Blad, B. L. and Shashi, B. V. 1983. Microclimate – The Biological Environment. John Wiley & Sons.

Sutherland, W.J. 2001. The Conservation Handbook --- Research, Management and Policy. Blackwell Science Ltd.

Taiganides, E.P. 1977. Animal Waste. Applied Science Publishers Ltd, England.

DEPARTMENT OF BIOTECHNOLOGY

Level-4, Semester-1 (Elective)

BTECH 401: Genetic Engineering and Biotechnology-Theory Credit hrs: 2, Contact hours: 2

- 1. Introduction:** Concept, scope and importance of Genetic Engineering.
- 2. Gene Manipulation:** Recombinant DNA technology, vectors, methods for gene delivery, selection of recombinants, site specific recombination/mutagenesis.
- 3. Molecular Techniques:** PCR, Southern, Northern and Western blotting; DNA sequencing, cDNA library.
- 4. Gene Expression:** Regulation of transcription in prokaryotes and eukaryotes, promoter, terminator, splicing and processing of RNAs, translation, operon concept.
- 5. Application of Genetic Engineering:**
Plants: Pest resistance, herbicide tolerance, resistance to fungi, bacteria and virus. Oxidative, salt, drought and submergence tolerance. Nutritional quality improvement: Provitamin A, iron, protein etc. Genetic manipulation for flower pigmentation, nitrogen fixation, photosynthesis, male sterility, fruit ripening, senescence tolerance. Edible vaccines in food products.
Fish and Animals: Production of transgenic animal and fish; feed quality improvement; dairy products and milk quality, recombinant protein.
Medicine and Industry: Commercial synthesis of hormones, vaccines, gene therapy, disease diagnosis, monoclonal antibodies, biomining, biogas, bioengineering. genome mapping, DNA fingerprinting, forensic medicine; enzymology, immunotechnology.
- 6. Biosafety and GMO:** Biosafety and environmental issues. Ethics and issues regarding genetically modified organisms. Religious and social acceptance of GMOs.

Text Books/References

Cunningham, C. and A. J. R. Porter. 2000. Recombinant Proteins from Plants. Humana Press, New Jersey.
Gupta, P. K. 1997. Cell and Molecular Biology. Rastogi Pub., India.
Mehga, P., D. F. Klessig, A. R. Oshmore, W. Cruissem, and J. E. Varner. 1995. Methods in Plants Molecular Bioloty, Cold Spring Harbour Lab. Press, New York.
Michael, W. F., S. W. Graham and M. M. Young. 1992. Plant Biotechnology. Pergamon Press, New York.
Old, R W and S.B. Primrose. 1989. Principles of Gene Manipulation. Blackwell Sci Pub., London.
Primorse, S.B. 1987. Modem Biotechnology. Blackwell Scientific Pub., London.
Rasko I. and C.S. Downes. 1995. Genes in Medicine. Champan and Hall, London.

BTECH 402: Genetic Engineering and Biotechnology-Practical Credit hrs: 2, Contact hours: 2

1. *Agrobacterium*-mediated transformation techniques; co-cultivation of explants.
2. Polymerase Chain Reaction (PCR)
3. Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP)
4. Randomly Amplified Polymorphic DNA (RAPD)
5. Southern, Northern and Western blotting
6. Bioassay tests
7. Radioisotopes, their uses and monitoring concept, counting efficiency; autoradiography.
8. Applications and types of chromatography.
9. Applications of UV and visible spectrophotometry, fluorimetry.
10. Cryopreservation and conservation of seed, plant sample, semen, embryo, revival of frozen germplasm.

Text Books/References

Ansabel, F. M., R. Brent, R. E. Kingston, D. D. Moore, J. A. Sidman, J. A. Smith and K. Struhl. 1993. Current Protocols in Molecular Biology. Wiley Pub., UK.
Brown, T. A. 2002. Gene Cloning and DNA Analysis. 4th Edition. Blackwell Pub., London.
Glover, D. M. and B. D. Hames. 1995. DNA Cloning-1 Core Techniques: A Practical Approach. Oxford University Press, UK.
Jane, K. S. and H. Alexander. 1982. Genetics engineering. Principles and methods Plenum Press, New York.
Kjellsson, G., V. Simonsen, and K. Ammann. 1997. Methods for Risk Assessment of Transgenic Plants. Birkhauser Verlag, Germany.
Raymond, L. R. and C. T. Robert. 1983. Recombinant DNA Techniques. An introduction. The Benjamin Cumming Publishing Co., London.
Robert, J. 1987. Tissue Culture of Selected Tropical Fruit Plants; a handbook on the application of tissue culture of plant propagation. FAO, Rome.
Sambrook, J., E.F. Fritsch and T. Manniatis. 1999. Molecular Cloning. Cold Spring Harbor Press, USA.
Slater, R.J. 1990. Radioisotopes in Biology- A Practical Approach. Oxford University Press, UK.

Level-4, Semester-2 (Elective)

BTECH 401: Genetic Engineering and Biotechnology-Theory Credit hrs: 2, Contact hours: 2

- 1. Introduction:** Concept, scope and importance of Genetic Engineering.
- 2. Gene Manipulation:** Recombinant DNA technology, vectors, methods for gene delivery, selection of recombinants, site specific recombination/mutagenesis.
- 3. Molecular Techniques:** PCR, Southern, Northern and Western blotting; DNA sequencing, cDNA library.
- 4. Gene Expression:** Regulation of transcription in prokaryotes and eukaryotes, promoter, terminator, splicing and processing of RNAs, translation, operon concept.
- 5. Application of Genetic Engineering:**
Plants: Pest resistance, herbicide tolerance, resistance to fungi, bacteria and virus. Oxidative, salt, drought and submergence tolerance. Nutritional quality improvement: Provitamin A, iron, protein etc. Genetic manipulation for flower pigmentation, nitrogen fixation, photosynthesis, male sterility, fruit ripening, senescence tolerance. Edible vaccines in food products.
Fish and Animals: Production of transgenic animal and fish; feed quality improvement; dairy products and milk quality, recombinant protein.
Medicine and Industry: Commercial synthesis of hormones, vaccines, gene therapy, disease diagnosis, monoclonal antibodies, biomining, biogas, bioengineering. genome mapping, DNA fingerprinting, forensic medicine; enzymology, immunotechnology.
- 6. Biosafety and GMO:** Biosafety and environmental issues. Ethics and issues regarding genetically modified organisms. Religious and social acceptance of GMOs.

Text Books/References

- Cunningham, C. and A. J. R. Porter. 2000. Recombinant Proteins from Plants. Humana Press, New Jersey.
- Gupta, P. K. 1997. Cell and Molecular Biology. Rastogi Pub., India.
- Mehga, P., D. F. Klessig, A. R. Oshmore, W. Cruissem, and J. E. Varner. 1995. Methods in Plants Molecular Bioloty, Cold Spring Harbour Lab. Press, New York.
- Michael, W. F., S. W. Graham and M. M. Young. 1992. *Plant Biotechnology*. Pergamon Press, New York.
- Old, R W and S.B. Primrose. 1989. Principles of Gene Manipulation. Blackwell Sci Pub., London.
- Primorse, S.B. 1987. *Modem Biotechnology*. Blackwell Scientific Pub., London.
- Rasko I. and C.S. Downes. 1995. Genes in Medicine. Champan and Hall, London.

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11. *Agrobacterium*-mediated transformation techniques; co-cultivation of explants.
12. Polymerase Chain Reaction (PCR)
13. Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP)
14. Randomly Amplified Polymorphic DNA (RAPD)
15. Southern, Northern and Western blotting
16. Bioassay tests
17. Radioisotopes, their uses and monitoring concept, counting efficiency; autoradiography.
18. Applications and types of chromatography.
19. Applications of UV and visible spectrophotometry, fluorimetry.
20. Cryopreservation and conservation of seed, plant sample, semen, embryo, revival of frozen germplasm.

Text Books/References

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