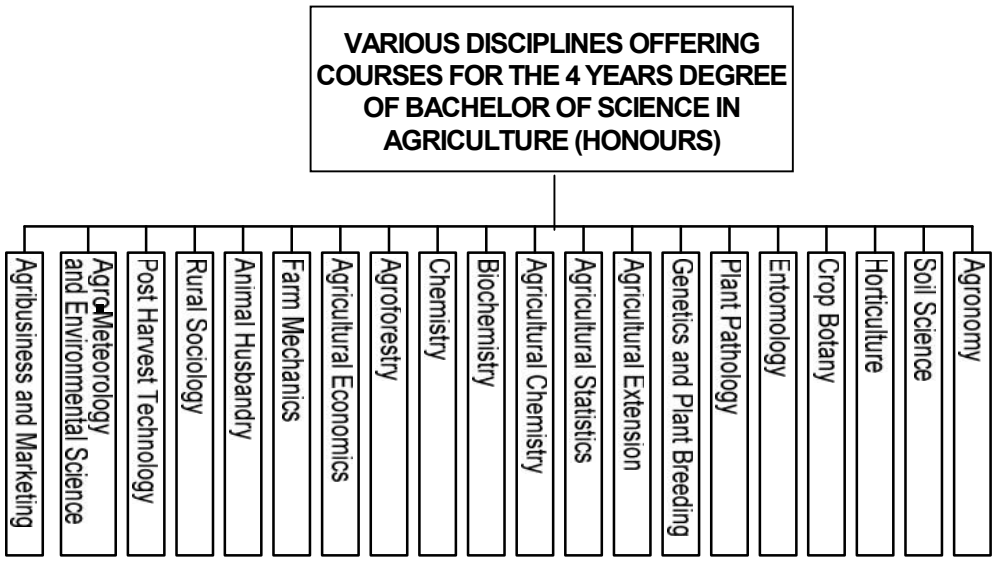
Syllabus for the B.Sc.Ag. (Honours) Degree

Session: 2011– 2012

1st Year Examination – 2012, 2nd Year Examination – 2013
3rd Year Examination – 2014, 4th Year Examination – 2015

DEPARTMENT OF CROP SCIENCE AND TECHNOLOGY
FACULTY OF AGRICULTURE
UNIVERSITY OF RAJSHAHI
RAJSHAHI-6205

Syllabus for the B.Sc.Ag. (Honours) Degree
Session: 2011– 2012



1st Year Examination – 2012, 2nd Year Examination – 2013
3rd Year Examination – 2014, 4th Year Examination – 2015

DEPARTMENT OF CROP SCIENCE AND TECHNOLOGY

FACULTY OF AGRICULTURE
UNIVERSITY OF RAJSHAHI

FOUR YEARS B.Sc. Ag. (HONOURS) DEGREE

The Bachelor of Science in Agriculture (Honours) degree is a four years integrated degree. There shall be 4800 marks including 100 marks for job oriented course (JOC) and 50 marks for Agricultural Practical Experience (Internship).

The examinations shall be held at the end of each academic year and the results shall be finalized on the basis of all these examinations.

The theoretical examinations shall include all the theory papers and the practical examinations shall cover the practical works both laboratory and field.

The agricultural practical experience (Internship) and the Job oriented course shall be evaluated in the 3rd and the 4th academic years.

The duration of the theoretical examinations for 50 marks shall be of 3 hours and for 75 marks of 4 hours. The duration of the practical examination for 50 marks shall be of 6 hours.

Year Wise Distribution of Courses and Marks for the Four Years B.Sc. Ag. (Hons) Degree

Years	No. of Courses	Theory Marks	Practical Marks	Viva Voce
1st Year	11	700	—	In practical courses
	9	—	450	
Total	**11+9 (20)**		**1150**	

2nd Year	11	750	—	In practical courses
	8	—	400	
Total	**11+8 (19)**		**1150**	

3rd Year	10	750	—	In practical courses
	11	—	550 including APE	
Total	**10+11 (21)**		**1300**	

4th Year	11	750	—	In practical courses
	9	—	450 including JOC	
Total	**11+9 (20)**		**1200**	
Grand Total	**43+37 = 80**	**2950**	**1850**	**4800**

OUTLINES OF COURSES AND MARKS FOR THE BACHELOR OF SCIENCE IN AGRICULTURE (HONOURS) DEGREE

PART-I

Total Theory Marks : **700**
Total Practical Marks : **450**
Total : 1150

Theory

Course Number and Title	**Marks**
CST. 101: Agronomy-I	50
CST. 102: Soil Science-I	75
CST. 103: Horticulture-I	50
CST. 104: Crop Botany-I	75
CST. 105: Agro-meteorology & Environmental Science	50
CST. 106: Farm Mechanics	50
CST. 107: Chemistry	75
CST. 108: Biochemistry-I	75
CST. 109: Agricultural Economics	75
CST. 110: Rural Sociology	75
CST. 111: Animal Husbandry	50
Total Marks =	**700**

Practical

Course Number and Title	**Marks**
CST. 112: Agronomy-I	50
CST. 113: Soil Science-I	50
CST. 114: Horticulture-I	50
CST. 115: Crop Botany-I	50
CST. 116: Farm Mechanics	50
CST. 117: Chemistry	50
CST. 118: Biochemistry-I	50
CST. 119: Agricultural Economics and Rural Sociology	50
CST. 120: Animal Husbandry	50
Total Marks =	**450**

PART-II

Total Theory Marks: **750**
Total Practical Marks : **400**
Total : 1150

Theory

Course Number and Title	Marks
CST. 201: Agronomy-II	75
CST. 202: Soil Science-II	50
CST. 203: Horticulture-II	50
CST. 204: Crop Botany-II	75
CST. 205: Entomology-I	75
CST. 206: Plant Pathology-I	75
CST. 207: Genetics and Plant Breeding-I	75
CST. 208: Agricultural Extension-I	75
CST. 209: Biochemistry-II	75
CST. 210: Agricultural Statistics-I	50
CST. 211: Agricultural Chemistry-I	75
Total Marks =	**750**

Practical

Course Number and Title	Marks
CST. 212: Agronomy-II	50
CST. 213: Horticulture-II	50
CST. 214: Crop Botany-II	50
CST. 215: Entomology-I	50
CST. 216: Plant Pathology-I	50
CST. 217: Genetics and Plant Breeding-I	50
CST. 218: Agricultural Extension-I	50
CST. 219: Agricultural Chemistry-I & Biochemistry-II	50
Total Marks =	**400**

PART-III

Total Theory Marks: **750**
Total Practical Marks: **550**
Total : 1300

Theory

Course Number and Title	Marks
CST. 301: Agronomy-III	75
CST. 302: Soil Science-III	75
CST. 303: Horticulture-III	75
CST. 304: Crop Botany-III	75
CST. 305: Entomology-II	75
CST. 306: Plant Pathology-II	75
CST. 307: Genetics and Plant Breeding-II	75
CST. 308: Agricultural Extension-II	75
CST. 309: Agricultural Chemistry-II	75
CST. 310: Agricultural Statistics-II	75
Total Marks =	**750**

Practical

Course Number and Title	Marks
CST. 311: Agronomy-III	50
CST. 312: Soil Science-II & III	50
CST. 313: Horticulture-III	50
CST. 314: Crop Botany-III	50
CST. 315: Entomology-II	50
CST. 316: Plant Pathology-II	50
CST. 317: Genetics and Plant Breeding- II	50
CST. 318: Agricultural Extension- II	50
CST. 319: Agricultural Chemistry-II	50
CST. 320: Agricultural Statistics-I & II	50
CST. 321: Internship Agricultural Practical Experience (APE)	50
Total Marks =	**550**

PART-IV

Total Theory Marks : **750**
Total Practical Marks : **450**
Total: **1200**

Theory

Course Number and Title	Marks
CST. 401: Agronomy-IV	75
CST. 402: Soil Science-IV	75
CST. 403: Horticulture-IV	75
CST. 404: Entomology-III	75
CST. 405: Plant Pathology-III	75
CST. 406: Genetics and Plant Breeding-III	75
CST. 407: Agricultural Extension-III	75
CST. 408: Post-harvest Technology	50
CST. 409: Agro-forestry	75
CST. 410: Agri-business and Marketing	50
CST. 411: Job Oriented Course	50
Total Marks =	**750**

Practical

Course Number and Title	Marks
CST. 412: Agronomy-IV	50
CST. 413: Soil Science-III	50
CST. 414: Horticulture-IV	50
CST. 415: Entomology-III	50
CST. 416: Plant Pathology-III	50
CST. 417: Genetics and Plant Breeding-III	50
CST. 418: Agricultural Extension-III	50
CST. 419: Agro-forestry	50
CST. 420: Job Oriented Course	50
Total Marks =	**450**

DETAILS OF SYLLABUS

B.Sc.Ag. (Hons) Part-I

THEORY COURSES

CST. 101: AGRONOMY–I

1. **Introduction to Agronomy:** Concept, importance, scope and basic principles. Evolution of agriculture.
2. **Agrometeorology of Bangladesh:** Concept, weather and climatic elements. Cropping seasons and their characteristics. Rainfall and temperature pattern and their influence on crop distribution.
3. **Crops and Cropping:** Concep of crops, Agronomic classification of crops. Concept of cropping patterns, Crop rotation, and mono and multiple cropping.
4. **Crop Geography:** Land topography and its types and characteristics. Distribution of crops in relation to climate and soil in world's perspective. Agroecological zones of Bangladesh-their characteristics and crop suitability.
5. **Tillage:** Concept, objectives and types. Advantages and disadvantages of different types of tillage. Effect of tillage on soil characteristics and nutrient availability. Determinants of time, depth and number of ploughing. Characteristics of ideal tilth.
6. **Crop Nutrition:** Essential elements, their criteria sources, the forms of absorption. Function, deficiency symptoms and toxic effects of nutrient elements in crop plants. Concept of Indicator Plants.
7. **Manures and Fertilizers:** definition, characteristics, classification and nutrient contents. Preparation and preservation of manures. Methods of application of manures and fertilizers; their advantages and disadvantages.
8. **Soil fertility and productivity:** Concept, maintenance of soil productivity through agronomic manipulation.
9. **Planting Practices:** Concept, types of planting materials. Planting methods, depth, density and their determinants. Field conditions for sowing.
10. **Intercultural Practices:** Concept, importance, varius operation, mulching, weeding, thinning, gap filling, earthingup - their concepts and objectives.
11. **Water Management:** Concept, sources, methods, advantages and disadvantages.

Books Recommended:

1. Das, P.C. 1997. Manures and Fertilizers. Kalyani Publishers. Ludhiana, New Delhi, Calcutta, 130p.
2. De, G.C. 1995. Fundamentals of Agronomy. Oxford & IBH Pub., New Delhi, Calcutta. 429p.
3. Mavi, H.S. 1974. Introduction to Agro-meteorology. Oxifrd & IBH Pub., New Delhi.
4. Morachan, Y.B. 1993. Crop Production and Management. 2nd Edition. Oxford & lBH Pub. New Delhi, Calcutta. 294p.
5. Simpson, K. 1986. Fertilizers and Manures. Longman Groups Limited, Hongkong.
6. Singh, S.S. 1996. Principles and Practices of Agronomy. 3rd Edition. Kalyani Publishers. New Delhi.
7. Iqbal, T.M.T., M.A. Gaffer, M.S.Alam, M.S. Amin & M.H. Ali, 2001. Fundamentals of Agronomy (in Bangali). Patrika Bichitra and Computer Centre, Kamal Ranjit Market, BAU, Mymensingh.

CST. 102: SOIL SCIENCE–I

Soil Genesis and Physics

1. **Concept of soil:** Definition, scope and branches of soil science, Major mineral soil components, mineral and organic soil; Soil profile, pH and fertility.
2. **Soil forming rocks and minerals:** Classification, properties of important rocks; properties and composition of lital minerals.
3. **Soil formation:** Concept of Physical, Weathering chemical and biological weathering. Soil forming factors. Soil forming process-eluviation and Illuviation; Podzolization, Laterization, Humification and Calcificaiton process.
4. **Geology and geography of Bangladesh:** Brief account of geological time scale; and tertiary hill sediments, Mathupur clay and recent alluviuam. Geography of hill, terraces and floodplains.
5. **Soil particles:** Soil separates and mechanical analysis, systems and particle size distribution; comparative characteristic of sand, silt and clay; Stoke's law; Soil texture – definition, classes, methods of determination, importance. Soil structure- definition, genesis and factors, classification, importance. Particle-density and bulk density; porosity, factors affecting bulk density and porosity of soil, importance.
6. **Soil air, colour, temperature and consistence:** Soil air–composition, factors affecting the composition, importance. Soil colour, soil aeration– definition, composition and colour, factors affecting soil colour. Soil temperature - sources of soil heat, factors affecting soil temperature, control and role of temperature. Concept of soil consistence.
7. **Soil water:** Definition, gain and loss of soil water, importance, structure, hydrologic cycle; energy concepts, soil water potential: componenets of soil water potential, Hg and gauge tensiometer method. Classification of soil water and constant. Soil water infiltration- definition, equations, methods, and factors. Concept and characteristics of irrigation water qualities.
8. **Evapotranspiration:** Definition of Evapotranspiration (ET) & Potential Evapotranspiration (PET), factors affecting ET, Methods of ET determination -Lysimetric and Pan Evaporimetric method.

Books Recommended:

1. Avwgb, Gg.Gm. Ges fyuBqv, †RW.GBP. 1982, g„wËKv weÁvb, †gv. mvBdzj Avwgb, †gvnbMÄ, gqgbwmsn|
2. Biswas, T. D. and Mukherjee, S. K. 1989. Text Book of Soil Science. Tata McGrow- Hill Pub. Co. New Delhi.
3. Baver, L. D. 1985. Soil Physics. John Wiley and Sons. New York.
4. Brady, N.C. 1989. The nature and properties of soils. McMillan Pub. Co. New York.
5. Foth, D.H. and Turk, L.M. 1983.Fundamentals of Soil Science. John Wiley and Sons. New York.
6. Page, A. L., R.H.Miller and D.R. Keeney. 1982. Methods of Soil Analysis. Part-II. Amer. Soc.Agron. Inc. Wisconsin.
7. Miller, R.W. and Donahue, R.L.1990. Soil-An introduction to Soils and Plant Growth. Prentice Hall, New York.
8. ingvb, Gg.Gm., Lvb, †K.G. Ges nvIjv`vi, wW.GBP. 1982, g„wËKv weÁvb, bvnvi KzwUi, ewikvj|
9. Das, D.K. 1999. Introductory Soil Science. Kalyani Publishers.
10. Sahai, V.N. 2001. Fundamentals of Soil. Kalyani Publishers.

CST. 103: HORTICULTURE – I

Fundamentals of Horticulture

1. **Introduction**: Origin, definition, history and branches of horticulture; different classification of horticultural crops, scope, importance and career opportunities of growing horticultural crops in Bangladesh.
2. **Growth and development of horticultural crops:** Plant form; the seed, the seedling, the vegetative plant, the flowering plant, the fruiting plants and ageing plant
3. **Introduction to general crop propagations:** Definition, outline of plant propagation, methods of propagation and their advantages and disadvantages, and specialized plant parts *viz*. graftage, buddage, cuttage and layerage; factors affecting root initiation in cutting and layering.
4. **Principles and practices of horticultural crop production:** Preparation of soil, methods of digging, raising of seedling, planting methods, factors affecting of spacing, irrigation and fertilizer doses, application of manures and fertilizer, intercultural operations, irrigation and harvesting; rotation of crops and multiple cropping.
5. **Nursery development, construction and maintenance:** Horticultural nursery – definition and objectives; different classes and section of horticultural nursery and their advantages and disadvantages, establishment of nursery, preparation of nursery bed, raising of seedling in nursery beds; potting, depotting and reporting.
6. **Introduction to pruning and training:** Definition, objectives, principles, methods, types, and effect of pruning and training;

Books Recommended

1. Adams, C. R.; K. M. Bamford and M. P. Early. 1993. Principles of Horticulture, British Library Cataloguing in Publication Data.
2. S. Prasad and U. Kumar.1999. Principles of Horticulture Agrobotanica. 4E 176 Jn. Vyas Nagar, Bikaner, India.
3. Jules Janick. 1982. Horticultural Science. Surojeet Publications, 7k, Koihapur, Kamla Nagor, Delhi.
4. J. B. Edmiond *et al*. Fundamentals of Horticulture. Tata McGraw-hill Publishing co. ltd. New Delhi.
5. Bose, T.K. and Yadav, L.P. 1989. Commercial Flowers Naya Praksh, Calcutta.
6. Bose, T. K.; S. K. Mitra and M. K. Sadhu. 1991. Propagation of Tropical and Subtropical Horticultural Crops. B. Mitra, Naya Prokash, 206, Bidhan Sarani, Calcutta, India
7. Hudson T. H.; E. K. Dale and T. D. Fred. 1993. Plant Propagation: Principles and Practices. Prentice Hall of India, Private Ltd. New Delhi.
8. Kuck. L.E and Tongg, R.C. 1960. The Modern Tropical Gardens, Tongg. Pun, Honolulu.
9. Laurie, A. and Ries, V.H. 1950. Floriculure, Fundamentals and Practices. Mc Graw - Hil, New York.
10. Macmillan, H.F. 1962. Tropical Planting and Gardenning Macmillan, London.
11. Surendra P. and U. Kumar. 1998-99. Principles of Horticulture. Agro Botanica, India.
12. Tata, S. N. 1992. Hand book of Agriculture. ICAR, New Delhi.

CST. 104: CROP BOTANY–I

Plant Morphology, Anatomy, Embryology, Taxonomy and Economic Botany

1. **External morphology of the following vital crops:** Rice, wheat, sugarcane, jute, mustard, tobacco, cotton groundnut, onion and tea, coffee and betel leaf.
2. **Cell:** Concept, structures and ultra-structures of protoplasmic components of cell, functions of important organelles.
3. **Cell wall:** Components and composition of cell wall, patterns of thickening, cell wall organization, plasmodesmata, pit- structures of simple and bordered pits and their functions, primary pit field.
4. **Tissue and tissue system:** Concept, classification and morphology of meristematic, simple, vascular and secretory tissues, structures and their functions, tracheary elements and sieve elements, vascular bundles and major types, tissue system- epidermal, procambial and vascular; epidermal appendages.
5. **Primary structure:** Concept of primary growth, structures of root and stem of monocot and dicot plants, structures of isobilateral and dorsiventral leaves.
6. **Secondary structure:** Concept of normal and anomalous secondary growth, activities of typical vascular cambium, formation of periderm and its functions.
7. **Anatomy of following crops:** 1) Rice, 2) Wheat, 3) Jute, 4) Cucurbits and 5) Lentil.
8. **Embryology:** Concept of sporogenesis and gametogenesis in cryptogams, microsporogenesis & microgametogenesis, megasporogenesis and megagametogenesis, pollination, fertilization, parthenogenesis, development of embryo, endosperm, seed, fruit and polyembryone.
9. **Taxonomy:** Introduction, concept of taxon and botanical nomenclature, principles and systems of plant classification.
10. **Distinguishing characters of the following plant families:** a) Gramineae, b) Leguminosae, c) Solanaceae, d) Cucurbitaceae, e) Compositae, f) Umbeliferae, g) Rutaceae, h) Anacardiaceae and i) Palmae.
11. **Economic plants:** Fibre, oil, timber, medicinal, rubber, narcotic and beverage yielding plants and their products of economic importance.

Books Recommended:

1. Carlquist, S. 1961. Comparative plant anatomy. Holt. Rinehart and Winston, New York.
2. Cobley, L.S. 1956. Introduction to botany of tropical crops. Longmans, London.
3. Cutter, E.G. 1971. Plant anatomy: experiment and interpretation. Edward Arnold, London.
4. Cutter, E.G. 1978. Plant anatomy. Vol. 1&2. Edward Arnold, London.
5. Dutta, A.C. 1975. Botany for degree students. 4th Ed. Oxford Univ. Press, Calcutta.
6. Eames, A.J. and MacDaniels, L.H. 1949. An introduction to plant anatomy. McGraw-Hill, New York.
7. Esau, K. 1977. Anatomy of seed plants. John Wiley, New York.
8. Gupta, R.K. 1961. Text book of systematic botany. 5th ed., Atea Ram Pub., Delhi.
9. Hill, A.F. 1952. Economic botany. 2nd ed., McGraw-Hill, New York.
10. Maheshwari, P. 1950. An introduction to the embryology of angiosperms. McGraw-Hill, New York.
11. Ohtani, J. 2000. Wood micromorphology. Hokkaido Uni. Press. Sapporo, Japan.
12. Pandey, B.P. 2000. Economic botany. 6th ed., S. Chand & Co., New Delhi.
13. Pandey, B.P. 2001. Plant Anatomy. S. Chand & Co., New Delhi.
14. Pophm, R.A. 1966. Laboratory manual for plant anatomy. C.V. Mosby, Saint Louis.
15. Purseglove, J.W. 1963. Tropical crops. Vol. 1&2. Longmans, London.
16. Rendle, A.B. 1967. The classification of flowering plants. Vol. 1&2. Cambridge Univ. Press, Cambridge.
17. Sivarajan, V.V. 1991. Introduction to the principles of plant taxonomy. 2nd ed., Cambridge.

CST. 105: AGRO-METEOROLOGY AND ENVIRONMENTAL SCIENCE

1. **Introduction to Agro-meteorology**: Concept and definition; scope and importance.
2. **Atmosphere:** Concept and definition; composition and structure
3. **Weather and Climate**: Definition**;** classification, Elements and factors controlling the climate and their influence on crops growth and development. Elements or components of wather:

a. **Solar Radiation:** Concept and meaning; forms; measurement; radiation and energy balance at the surface; distribution of radiation.

b. **Temperature:** Definition, terminology-Diurnal and seasonal variation, horizontal and vertical variation, temperature gradient, laps rate, adiabatic lapse rate, process of heat transfer; heating and cooling of atmosphere; distribution of temperature.

c. **Humidity and Rainfall:** Definition, terminology, properties of water vapour, time variation in humidity. Precipitation: Definition, forms, types and measurement. Fog, dew, cloud, flood and drought: Definition, classification, description and distribution.

d. **Wind:** Definition and measurement; geographic and sesonal variation of wind.

4. **Weather Forecasting and Analysis**: Concept and historical background; Types of weather forecasting: short, medium and long range, Methods of weather forecasting.
5. **Environments:** Concept and meaning; principles in relation to organism and environment; different factors.
6. **Environmental Pollution:** Introduction to Environmental pollution, pollution of air, soil, water, and noise.
7. **Air Pollution:** Causes, carbon dioxide balance- Introduction, CO_2 concentration pattern, CO_2 balance of growing crops. Effects of atmospheric ozone (O_3) on crops, green house gases and ozone layer depletion.
8. **Soil Pollution:** Concept of soil pollution, soil degredation, nature of degradation. Concept of soil pollution by heavy mattels: As, Pb, Cu, Cr, Cd, Hg etc., its causes and adverse effects. Pestiside pollution in soils and their residual effects.
9. **Water pollution:** Water polution and its causes adverse effects of water pullution, pollution from industrial, agricultural and domestic and others sources. Ponds, cannels, rivers and sea water pollution.
10. **Environmental Problems in Bangladesh:** Environmental degradation from industries and agricultural fields. Domestic wastes and disposals, weather change, water supply and sanitation.

Books Recommended:

1. Ambasht, R.S. and K.N. Ambasht. 2000. A text book of plant ecology. CBS Publisher and distributor, Daryagong, New Delhi.
2. Bannister, P. 1976. An Introduction to Physiological Plant Ecology, Blackwell, Oxford.
3. Bucknell, J. 1966. Climatology, 1966. McMillan, N.Y.
4. Chang, J.H. 1971. Climate and Agriculture, Aldine Pub. Co. Chicago.
5. Mather, J.R. 1974. Climatology: Fundamentals and applications, McGraw Hill Book Company, London.
6. Jackson, I.J. 1982. Climate, water and agriculture in the tropics, English Language Book Society, London.
7. iwdK Avn‡g`, 1997, Avenvlqv I Rjevqy weÁvb, evsjv GKv‡Wgx, XvKv|

CST. 106: FARM MECHANICS

Farm Power and Management

1. Engine: Definition of engine and thair classification, major components of engine, engine terminelogy, engine systems, maintenance of engine.
2. Introduction to farm machinery: Tillage, crop planting and plant protection machinery, repair and maintenance of farm machinery.
3. Importance of drying and classification of dryers.
4. Irrigation and its importance in Banlgadesh. Methods of irrigation, irrigation efficiency, classification of pumps and introduction to pumps commonly used in Bangladesh.
5. Farm power and mechanization: Sources of agricultural power in Bangladesh, mechanization and agricultural mechanization, objective of mechanization, type of mechanization, problems and prospects of agricultural mechanization in Bangladesh.
6. Introduction to common building materials: Brick, sand, cement and timber, estimation of simple building structures seasoning of timber and bamboo.

Books Recommended:

1. Chakravarty, A. 1995. Post Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Pub. Co. Pvt. Ltd. India.
2. Hafiz, M.A. 1990. A Text Book of Engineering Materials. Book Centre, Dhaka.
3. Hunt, D. 1983. Farm Power and Machinery Management. Iowa State University Press. Ames.
4. Kepner, R. A., Bainer, R. and Berger, E.L. 1983. Principle of Farm Machinery. AVI Pub. New York.
5. Singh, S. S. (ed.) 1995. Handbook of Agricultural Sciences. Kalyani Publisher, India.
6. Srivastava, A. C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co. Pvt. Ltd. India.
7. Uddin M. S. 1993. Agricultural Engineering (Tractor). Vol. I. A. Jahan Seyra Pub. Mym

CST. 107: CHEMISTRY

Physical, Analytical and Organic Chemistry

1. **Physical and Analytical Chemistry**

   i. **Chemical Equilibrium:** Reversible reaction, Chemical equilibrium. Law of mass action, mathematical formulation and its applications. Effect of temperature and pressure on chemical equilibrium.

   ii. **Oxidation and Reduction:** Definition of oxidation and reduction, redox reaction; oxidation number.

   iii. **Electro Chemistry:** Ionic equilibrium (Oswald low of dilution) buffer solution, buffer activity, buffer capacity, pH & pOH of solution, ionization, constant of water.

   iv. **Analytical chemistry:** Chemical analysis, types of analysis, principals of volumetric analysis, and base titration, oxidation-reduction titration, precipitation titration, and complexometric titration, colarimetry and spectrophotometric analysis. Beer and Lamberts law and its application.

   v. **Colloids and crystalloids:** Classification of colloids general methods of preparation of colloidal solution. Properties of colloids, coagulation Peptitization, electropherosis.

2. **Organic Chemistry**

   i. **Introduction:** Definition and scope. Aliphatic, Aromatic, Saturated and unsaturated hydrocarbon. Structure of molecules O, N, C orbital and hybridization of orbitals.

ii. **Chemical bonding:** Covalent bonding, σ, π bond hydrogen bonding, cleavage of covalent bond (Carbonium ion, Carbonion, free radical)

iii. **Chemical reactions:** Different types of chemical reactions, classification of reagents.

iv. **Carbonyl compounds**: Aldehydes and ketone.

v. **Carboxylic acids:** Different types of carboxylic acids. Mono, di, tri.

vi. **Amino acids:** Definition of amino acid, Reaction of $-NH_2$ and–keton group.

vii. **Stereochemistry:** Fundamental terms–stereochemistry of compound containing one or two asymmetric carbon atom, ad geometrical isomerisom.

viii. **Heterocyclic compounds:** Definition and numbering of some compounds.

Books Recommended:

1. Modern Concepts in Biochemistry by R.C. Bohinski.0
2. Principles and problems in physical chemistry for biochemists, N.C. Price and R.A. Dwek.
3. Physical Chemistry with applications to life sciences by D. Fisanberg and D. Chrothers.
4. Physical Chemistry, Principles and applications to life sciences by Tinoco.Jr, K.Sauer & J.C.Wang.
5. Physical Chemistry by N.Kundu & S.K.Jain, 1996.
6. Modern Inorganic Chemistry by S.Z.Haider, 1974.
7. Modern Inorganic Chemistry by R.D.Madan.
8. Basic Inorganic Chemistry by F.A.Cotton & G.Wilkinsons.
9. Organic Chemistry, 6th Edtn by R.T. Morrison and R.N.Boyd, 1974.
10. Organic Chemistry Vol. I & 2 by I.L.Finar, 1985.

CST. 108: BIOCHEMISTRY–I

Food Biochemistry and Nutrition

1. Introduction to nutritional biochemistry.
2. Biochemistry of food nutrients:
   a. **Carbohydrates:** Definition, occurrence, source, classification, biological importance and nutritive values.
   b. **Proteins:** Definition, occurrence, source, classification, biological importance and nutritive values.
   c. **Lipids:** Definition, occurrence, source, classification, biological importance and nutritive values.
   d. **Vitamins:** Structure, co-enzyme activity, classification, dietary sources, recommended daily allowance and deficiency symptoms.
   e. **Minerals:** Sources, role in metabolism, deficiency symptoms, daily requirements. Interrelationship between vitamins and micronutrients.
3. Nutrient contents of food crops like cereals, legumes, oil seeds, nuts, fruits, vegetables and their availability. Anti-nutritional factors. Dietary fiber.
4. Comparative nutritive value of plant foods and animal foods.
5. Digestion and absorption of carbohydrates, proteins and lipids in human.
6. Balanced diet: Balanced diet, BMR, SDA. Diet chart for different act growing. Energy requirements according to Age, Sex and Size.
7. Effect of post-harvest handling and processing on the nutrient contents of food substances.
8. Nutritional problem: Nutritional problems in Bangladesh and to combat the malnutrition in Bangladesh. Diseases due to specific nutritional deficiency.
9. Food habit and balanced nutrition calculation.

Books Recommended:

1. Albanese, A.A. 1980: principles of Biochemistry. Worth Pub. Philadelphia.
2. Burton B. T. 1976: Human Nutrition, 3rd ed. Tata MeGraw Hill, New Delhi.
3. Conn. E. E and Stumpf, P. K. 1984: Outline of Biochemistry, 5th ed. Hohn Wiley and Sons, New York.
4. Lehninger. A. I. 1980: Principles of Biochemistry. Worth Pub. Philadelphia.
5. West and Toad. 4th edition, 1974. Text Book of Biochemistry, Oxtord & IBH Pubishing Co.Pvt. Ltd.
6. Street. 1967. Plant Metabolism, Pergam Press. London.
7. Dev. A.C. 2006. Fundamentals of Biochemistry. 8th edition, New Central Book Agency (P) Ltd. Kolkata.

CST. 109: AGRICULTURAL ECONOMICS

1. **Introduction:** Definition of economics; Micro economics and Macro economics; Basic concepts in economics; Definition of agricultural economics; Special Characteristics of Agricultural Economics; Distinguishing feature of agricultural products in relation to industrial products; Farmer's role as a decision maker.
2. **Consumer Behaviour and Demand:** Demand and supply analysis; Marshallian utility analysis; Indifference curve analysis; Consumer's surplus and producer's surplus.
3. **Elasticity of demand:** Definition and types of elasticity of demand; Degrees of elasticity of demand; Mathods of measuring price elasticity of demand; Factors affecting elasticity of demand.
4. **Factors of production:** Meaning of production; Factors of production-land, Labour, Capital and Organization; Efficiency of labour; Factors affecting efficiency of labour; Methods of improving efficiency in the use of farm labour; Division of labour; Advantages and disadvantages of division of labour.
5. **Production Function:** The concept of production function; Law of diminishing returns and the three stages of production; Law of increasing, constant and decreasing returns, Iso-quant, production possibility curve, Marginal rate of substitution; Cost of production- Fixed cost and variable cost, Short run and Long run, Opportunity cost; Profit maximization and cost minimization for an agricutlural enterprise. Economic efficiency; Technical efficiency and Allocative efficiency.
6. **Banking, Money & Agricultural credit:** The concept of a bank and money; Types of bank, Functions of central, commercial and specialized banks; Hypothetical balance sheet of a commercial bank; Agricultural credit and its sources.
7. **Land tenure, Land reform & Size of Farm:** Types of farm size, Factor influencing the size of farm, measures of farm size; Land tenure and productivity in Bangladesh; Land reform in Bangladesh.
8. Hypothetical economic analysis of costs and returns of different agricultural crops.

Books Recommended:

1. Henderson J. M. & Quandt, R. E. Microeconomic Theory- A Mathematical Approach.
2. Bishop, C. E. and Toussiant W. D. 1958: An Introduction to Agricultural Economic Analysis. John Wiley and Sons, New York.
3. Dewett K. K. 1984: Modern Economics Theory. Shyam Lal Charitable Trust, New Delhi.
4. Hill, B. 1990: An Introduction to Economics for Students of Agriculture, Pergamon Press, London.
5. Ritson, C. 1977: Agricultural Economics: Principles and Policy, Granada Pub, London.
6. Samuelson, P. A. 1989: Economics. 13th Edition. McGraw-Hill New York.
7. John P. Doll and Frank Orazem. 1984: Production Economics. 2nd Ed, John Wiley & Sons, Inc.
8. Chandler, L. W.: Economic of Money & Banking. Harner and Row London.
9. Ahuja, H. L.: Advanced Economic Theory.

CST. 110: RURAL SOCIOLOGY

1. **Introduction:** Definition, origin and scope. Importance of Rural Sociology, role of the Rural Sociologists in Agricultural Development.
2. **Rural livelihood and sustainability:** Definition of livelihood and changing socio-economic activities, institutional arrangement, integrated farming system: agriculture, rice-fish culture, poultry and livestock.
3. **Culture:** Rural culture or peasant culture, elements, characteristics and functions of culture, interpreting culture, cultural complexities and diversities, cultural changes.
4. **Social stratification:** Definition, types and function of stratification, basis and nature of stratification in Bangladesh, rural class and power structure.
5. **Social Change:** Nature and factors of social changes, social mobility, evolutioin and progress, causes of social change, adaptability and rural life.
6. **Family:** Concept, types and function of family. Family and agriculture in Bangladesh.

Books Recommended:

1. Chitamber, J.B. 1973. Introductory Rural Sociology, New Delhi: Willy Eastern Limited.
2. Karim, A.H.M. Zehadul. 1990. The Pattern of Rural Leadership in an Agrarian Society: A Case Study of Changing Power Structure in Bangladesh, New Delhi: Northern Book Centre.
3. nvB, nvmbvZ Avãyj, 1990, cj-x Dbœqb, XvKv : cj-e cÖKvkbx|
4. †nv‡mb, KvRx †ZveviK I Bgvg, gynv¤§` nvmvb, 2000, evsjv‡`‡ki MÖvg (m¤úvw`Z), XvKv mvgvwRK weÁvb Dbœqb †K›`ª|
5. gynv¤§`, Avby, 1988, evsjv‡`‡ki MÖvgxY mgvR I A_©bxwZ, XvKv, mviv cÖKvkbx|
6. Chitamber, J.B. 1973. Introductory Rural Sociology, New Delhi: Willey Eastern Limited.
7. Desai, A.R. 1978. Rural Sociology in India, Bombay: Popular Prakashan.
8. Khan, F.R. 1969. Principles of Sociology, Dhaka: Shirin Publications.
9. Khan, F.R. Sociology in Bangladesh, Dhaka: Shirin Publications.
10. Maclver, R.M. and C.H. Rage, 1967. Society: An Introductory analysis, MacMillary, India Limited.
11. Avjx, G.Gd. Bgvg, 1998, mgvRZË¡, XvKv-ivRkvnx †m›Uvi di evsjv‡`k ÷vwWR, XvKv |
12. Kwig, bvRgyj, 1976, mgvRweÁvb mgx¶Y, XvKv: bI‡ivR wKZvwe¯—vb|
13. wgRvbDÏxb, gyn¤§`, 1991, mgvRweÁvb: cÖZ¨q I c×wZ, ivRkvnx wek¦we`¨vjq, cvV¨cy¯—K cÖKvkbv †evW©|
14. ingvb, G.GBP.Gg. †gv¯—vwdRyi I ûmvBb, †gv: BKevj, 2006, mgvRweÁvb cwiwPwZ, XvKv: †jLvcov|
15. ingvb, nvweeyi, 1998, mgvRweÁvb cwiwPwZ: XvKv : nvmvb eyK nvDm|

CST. 111: ANIMAL HUSBANDRY

1. **Introduction:** Definition of animal science and livestock, roles of livestock and poultry in socio-economic development of Bangladesh. Constraints of statistics, terminology.
2. **Breeds:** Classification of livestock and poultry according to their uses. Definition of breed, type, class, species, variety of livestock and poultry. General characteristics of different types of livestock and poultry breeds and name of the breeds, importance and constraints of draft animal production in Bangladesh.
3. **Judging of livestock:** Definition and procedure for judging of draft animal, requisite qualification of a good livestock judge. Characteristics and confirmation of draft animal.
4. **Livestock feed and feeding system:** Composition of plant and animal body, principal feeds and their classification according to their feeding values. Essential feed nutrients and their function in animal body. Feeding value of common concentrated fodder, forages, crop residues and agro-industrial by- products. Definition of feed digestibility. Metabolizeable

energy, ration, total digestible nutrients (TDN), digestible protein (DP), principles and preparation of hay and silage, requisites of good quality ration for livestock.

5. **Housing of livestock:** Principles of housing of livestock and poultry. Advantages and disadvantages of housing of animals. Site selection for livestock farm. Types and system of housing for livestock and poultry. Floor space requirement of livestock and poultry.
6. **Livestock management:** Importance of management practices in farm. Definition, objectives, methods and tools required for grooming, castration, dehorning and disbudding, marking, washing, clothing, bedding and their advantage and diadvatage.
7. **Animal products and by-products:** Definition and composition of milk, meat, egg and other dairy products–cream, ice-cream, butter, dadhi and ghee. Different types of animal by-products from slaughter house and their uses.
8. **Diseases of animals:** Definition of animal health and disease. Sings of ill health. Category of diseases of livestock and poultry. General programmes for prevention and control of diseases. Symptoms and control of common diseases of livestock and poultry.

Books Recommended:

1. Banerjee, G.C. 1982. A Text Book of Animal Husbandry. 5th ed. Oxford and IBH Pub. Co. New Delhi.
2. Cole, H.H. 1962. Introduction to Live Stock Production. W. H. Freeman and Co. San Francisco.
3. Peterson, 1950. Dairy Science. 2nd ed. J.B. Lippincott, Chicago.
4. Miller, W.C. and Roberton, D.S. 1959. Practical Animal Husbandry. Cliver and Boyd. London.
5. Morrison, F.B. 1954. Feeds and Feeding. Morrison Pub. N.Y.
6. Sing, S.S. (ed.) 1995. Hand Book of Agricultural Sciences. Kalyani Pub. India.
7. Willamson, P. 1959. An Introduction to Animal Husbandry in the Tropics. Longhman Group. London.

PRACTICAL COURSES

B.Sc.Ag. (Hons) Part-I

CST. 112: AGRONOMY–I

1. Introduction to farm implements- (a) identification, (b) practicing of different operations and (c) determination of their efficiency.
2. Identification of soil textural clases by the finger feel method.
3. Identification of manures, fertilizers and noting their physical characteristics.
4. Computation of manures and fertilizers for different crops.
5. Preparation of compost.
6. Preservation of farm yard manure.
7. Practising weeding, thinning, gap filling, mulching and earthingup in crop filed.
8. Study of meteorological tools and instruments and climatic pattern of Bangladesh.

CST. 113: SOIL SCIENCE–I

1. Precautions to be taken while working in the laboratory.
2. Collection and Preservation of soil samples.
3. Identification of important rock and mineral specimens.
4. Determination of soil pH by colorimetric method.
5. Determination of soil colour by Munsell colour charts.
6. Particle size analysis of soil by hydrometer method and estimation of soil textural class.
7. Determination of pore size distribution of soil.
8. Determination of Bulk density of soil by core sampler method.
9. Determination of Particle density of soil by volumetric flask method.
10. Determination of soil water infiltration by ring infiltrometer method.
11. Determination of saturated hydraulic conductivity of soil by constant head method.
12. Determination of soil moisture by tensiometer method.
13. Determination of Atterberg limits-liquid limits, plastic limit and plasticity index.

CST: 114: HORTICULTURE–I

1. Identification of important ornamental plants in different areas of Bangladesh and preparation of album.
2. Propagation practices of important ornamental plants and flowers by cutting.
3. Introduction to modern nursery highlighting its components.
4. Identification of different nursery tools and their uses.
5. Preparation of a seed bed and raising of seedlings.
6. Annual nurseries activities and year round plan and work schedule of nursery.
7. Pruning and training practices of horticultural plants.
8. Different planting methods of horticultural crops sowing,, dibbling, transplanting and planting.

9. Potting, depotting and repotting practices.
10. Methods of digging (Single and double digging) of horticultural plants.
11. Practicing different application methods of manure and fertilizer in vegetables and fruits.
12. Survay of a horticultural farm, identification of its problems and suggestion for their improvments.

CST. 115: CROP BOTANY–I

1. **External morphology of the following crops and their relatives:** Rice, wheat, sugarcane, jute, mustard, tobacco, groundnut, onion, lentil, brinjal, cucurbit and sunflower.
2. **Slide preparation:** Sectioning, staining and mounting, temporary and semi-permanent slides, demonstration of microtome and maceration techniques.
3. **Demonstration of the following:**
   a) Nucleus, nucleolus, plastids, primary wall, secondary wall, thickening of cell wall;
   b) Parenchyma, collenchyma, sclereid, fibre and secretory cells both in transverse and longitudinal sections/macerated materials;
   c) Structure of anther, pollen, pollen germination, hand pollination technique, ovary, ovule and placenta.
   d) Internal structures of isobilateral and centric dorsiventral leaves.
4) **Anatomy of dfiffernt crops:** Stem and root of maize, rice, wheat, cucurbit, groundnut and jute; leaves of monocot and dicot plants.
5) Preparation of a herbarium and field visit**.**
6) Field laboratory/ botanical garden visit.

CST. 116: FARM MECHANICS

1. Introduction to some basic parts of an IC engine.
2. Introduction to engine cooling systems.
3. Introduction to a petrol engine fuel system.
4. Introduction to lubricating system of an engine.
5. Repair and maintenance, trouble shooting and power transmission system of C.I and S.I engines.
6. Introduction to a centrifugal pump.
7. Operation of power tiller and tillage implements.

CST. 117: CHEMISTRY

Section- A

1. Preparation of primary standard solution of Na_2CO_3 and Oxalic acid.
2. Preparation and standardization of NaOH, HCl & H_2SO_4 solution.
3. Estimation of iron from ferrous sulphate.
4. Iodometric determination of copper by Iodometrically.

Section- B

1. Determination of plant constituents-alkaloids, flavonoids.
2. Organic qualitative analysis: Detection of elements and identification of functional groups present in organic compounds containing not more than two functional groups.

CST. 118: BIO-CHEMISTRY – I

1. Use of an analytical balance.
2. Preparation of various standard solutions.
3. Calibration of volumetric apparatus.
4. Acid base titration:
   a) Titration of a mixture of a strong acid and a weak acid.
   b) Titration of a strong acid with a strong base.
   c) Titration of a weak acid with a strong base.
5. Qualitative test of carbohydrates and proteins and vitamins.

CST. 119: AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

1. Field survey:
   - Its methods and application
   - Socio-economic survey at the village level
2. Cropping intensity and intensity of land use
3. Measures of efficiency:
   - Production efficiency
   - Labour efficiency
4. Hypothetical estimation of cost and return for different crop-enterprises
   - Enterprise costing/ Cost accounting
   - Accounts analysis
   - Gross margin analysis

CST. 120: ANIMAL HUSBANDRY

1. Approach and control of livestock
2. Introduction to external body parts.
3. Estimation of age and weight.
4. Common appliances used in livestock management.
5. Recording of temperature, pulse and respiration rates.
6. Introduction to common feeds and fodders.
7. Determination of specific gravity, fat and SNF of milk.
8. Detection of adulterants in milk.
9. Introduction to artificial insemination of a cow.
10. Visit to livestock farm.
11. An introduction to incubation/hatching.
12. Castration of animals.

THEORY COURSES

B.Sc.Ag. (Hons) Part-II

CST. 201: AGRONOMY–II

5. **Introduction to Seed:** Definition, importance, classification and structure, formation and development of seed.
6. **Seed Quality:** Determination of seed quality. Attributes of quality seed. Importance of quality seed in crop production. Factors affecting seed quality during production and processing.
7. **Seed Germination and Vigour:** Definition and process of germination. Conditions necessary for germination. Concept of seed viability and vigour. Significance of seed vigour in crop production.
8. **Seed Dormancy:** Definition, kinds and causes. Importance of dormancy in crop production. Means of breaking seed dormancy.
9. **Seed Rate:** Concept, planting value of seed. Factors affecting seed rate.
10. **Seed Crop Cultivation:** Basic principles, methods of cultivation and harvesting of seed crop. Processing and grading of seed.
11. **Principles of Seed Storage:** Environmental factors affecting seed in storage. Types of storage facilities for seed. Safe conditions for seed storage. Factors affecting seed longevity deterioration. The processes involved in seed deterioration.
12. **Seed Treatment:** Objectives and procedures. Seed treating chemicals.
13. **Seed Testing:** Definition and objectives. Seed sampling. Testing of seeds for moisture, purity, germination, viability and vigour.
14. **Quality Control of Seed:** Definition and objectives. Seed certification procedure. Role of National Seed Board, Seed Certification Agency in the quality control of seed. Present status of production and supply of seed in Bangladesh.
15. **Introduction to Weed:** Definition, characteristics and classification. Agricultural and non-agricultural losses caused by weeds. Positive value of weed, brief account of the common weeds of Bangladesh with emphasis on the biology of major weeds.
16. **Survival Mechanism of Weed:** Propagation, dispersal and persistence.
17. **Distribution of Weeds:** Weed distribution in relation to soil, season, land topography, crop and crop production practices.
18. **Crop-Weed Competition:** Concept, critical period of weed competition and factors affecting crop-weed completion, competitive ability of weeds and the factors affecting it. Allelopathic effects of weeds on crops and vice-versa
19. **Weed Management:** Concept and principle of integrated weed management. Prevention and eradication of weed. Cultural, mechanical, biological and herbicidal methods of weed control-their advantages and disadvantages. Classification, formulation and mode of action of herbicides. Methods of herbicides application. Factors affecting the foliage and soil applied herbicides. Herbicide selectivity and factors affecting it. Herbicidal weed control in major crops, viz. rice, jute, maize, puls/oilsidees wheat, cotton and sugarcane. Toxic symptoms of herbicides in weeds and crops. Effects of herbicide on environment.

Books Recommended:

Basra. A.S. (ed.). 1995, Seed Quallity: Basic Mechanisms and Agricultural Implications, Food Product Press, New York.

Bewley. J.D. nod Black. M. 1994. Seed Physiology of Development and Germination. 2nd edition. Sp inger-Verlag, London

Copeland, L.O. and McDonald. M.B. 1995. Seed Science and Technology. 3rd Edition. Chapman & Hall. New York.

Hampton. J.G. and Tekrony. D,M. (eds.). 1995. Handbook of Vigour Test Methods. 3rd Edition. International Seed Testing Association, Zurich, Switzerland.

ISTA. 1999. International Rules for Seed Testing. 1999. Supplement to Seed Science and Technology. Vol. 27. pp. 27-32.

McDonald, M.B. and Copeland. L. 0. 1997. Seed Production: Principles and Practices. Chapman & Hall, New York.

Aldrish, R.J, 1984. Weed-crop ecology- Principles in Weed Management. Breton Pub.s, Massachusetts, U.S.A.

Alter, M.A. and Liebman, M. 1988. Weed Management in Agroecosystem: Ecological Approaches, CRC Press, Inc. Boca Raton Florida. U.S.A.

Auld. B.A. and K.U, Kim. 1996. Weed Management in Rice. Published by FAO Rome, Italy.

Grafts, A.S. and Robbins. W.W. 1973. Weed Control. Tata-McGraw-Hill Publishing Co. Ltd., New Delhi, 669p.

Griffiths, W. 1990. Weed Guide. Published by Schering Agriculture, Stapleford, Nottingham NG98AG, U.K.

Gupta. O.P. and Lamba, P.S. 1978. Modern Weed Science. Today and Tomorrow's Printers and Pub., New Delhi.

Hance, R.J. and Holy. K. 1990. Weed Control Hand Book: Principles, 8th Edn. Blackwell Sc. Pub., Oxford.

Holm, L.G.; Doll, J., Holm, E., Pancho. J. and Herberger, J.P 1977. The Worlds Weeds: Distribution and Biology. University Press of Hawaii, Honolulu.

Hill, T.A. 1977. The biology of weeds. Studies in Biology. No. 79. Edward Arnold. London.

Herberger, J.P.1997. World weeds: Natural histories and distributions. Wiley, New York, U.S.A.

Labrada, R.; Caseley, J.C. and Parker, C. 1994. Weed Management for developing countries. FAO, Rome, Italy.

Morita. H. 1997. Handbook of Arable weeds in Japan- For correct identification. Published by Kumiai Chemical Industry Coo. Ltd., Taitoh-ku, Tokyo 110, Japan.

Zimdahl,, R.L. 1980. Weed-crop competition- a review. International Plant Protection Centre, Oregon State University, Comallis, Oregon, U.S.A.

CST. 202: SOIL SCIENCE–II

Soil Survey, Classification and Conservation

1. **Soil Survey:** Definition, objectives, kinds and methods of soil survey, concept of mapping and report preparation.
2. **Soil Classification:** Definition, objectives, principles, introduction and brief history of soil classification, soil Taxonomy–concept, categories, major features and derivation of diagnostic horizons, characteristics of soil orders and equivalent general soil types of Bangladesh.
3. **Soil erosion and conservation:** Soil erosion–definition, kinds, types of water erosion, factors affecting soil erosion, universal soil loss equation (USLE). Soil conservation-objectives and techniques of soil conservation.
4. **Soils of Bangladesh:** Agro-Ecological Zones (AEZ)–Concept and criteria for AEZ classification, Short description of AEZs-location, extents, physiography, land types, ecological hazards, important nutrient status or deficiency areas. Name and concept of general soil types of Bangladesh.

5. **Land capability classification:** Criteria for land evaluation, land types and land capability classification of Bangladesh.

Books Recommended:

1. Amin, M. S. and Bhuiya, Z. H. 1982. Mrittika Biggan, Maghan, Mohanganj, Mymemsingh.
2. Biswas, T. D. and Mukherjee, S. K. 1989. Text Book of Soil Science. Tata McGraw Hill Pub. Co. New Delhi.
3. Brady, N. C. 1989. The Nature and Propertice of Soils. McMillan Pub. Co. New York.
4. FAO. 1988. Agroecological Regions of Bangladesh. Report No. 2. UNDA / FAO. Rome.
5. Foth, D. H. and Turk, L. M. 1973. Fundamentals of Soil Science. John Wiley and Sons. New York.
6. Green land, D. J. and Lal, R. 1977. Soil Conservation and Management in the Humid Tropics. John Willy and Sons. New York.
7. Idris, M. 1987. Erosion Hazard areas in Bangladesh. Report on Soil Conservation. SRDI, Dhaka.
8. Soil Survey Staff. 1978. Soil Txonomy. A basic classification. Agricultural Handbook No. 456. Soil Conservation Service. USDA.
9. Stallings, J. N. 1962. Soil Conservation. Prentice Hall. In. USA.
10. Das, D.K. 1999. Introductory soil science. Kalyani Publishers.
11. Sahai, V.N. 2001. Fundamentals of Soil. Kalyani Publishers.

CST: 203: HORTICULTURE – II

Floriculture and Landscape Horticulture

1. **Introduction:** Definition, origin and history of ornamental plants, classification of ornamental plants, scope, importance and careers of growing ornamental plants in Bangladesh.
2. **Production and management of bedding flowers**: Zinnia, cosmos, calendula, globe amaranth, phlox, antirrhinum, dianthus, corn flower and lupin.
3. **Production and management of commercial and cut flowers**: Rose, dahlia, chrysanthemum, carnation, tuberose, gladiolus, marigold, aster, jasmine, lilies and lotus.
4. **Production and management of ornamental plants**: Shrubs, trees, palms, ferns, cacti and orchids.
5. **Special technique in ornamental horticulture:** Development and maintenance of bonsai, topiary and shrubbery.
6. **Garden architecture and decoration:** Establishment and maintenance of home and institutional gardens, water-gardens, rock gardens, parks and Japanese garden.
7. **Floral arrangement:** Principles and style of floral arrangement, floristry, floral crafts, and dehydrated flowers and foliages.
8. Turf **Management**: Development and maintenance of lawn, turf and hedges.
9. **Landscape horticulture and its design:** Concept and definition, objectives and categories of landscape horticulture, Landscape design: landscape professonals, elements of design, principles of design, landscape planning for different places (residential and non-residential landscape) scope and importance of landscape gardening in Bangladesh.

Books Recommended

1. S. Prasad and U. Kumar.1999. Principles of Horticulture. Agrobotanica. 4E 176 Jn. Vyas Nagar, Bikaner, India.
2. Jules Janick, 1982. Horticultural Science. Surjeet Publications, 7k, Koihapur, Kamla Nagor, Delhi.
3. J. B. Edmiond *et al.* Fundamentals of Horticulture. Tata McGraw-hill Publishing co. ltd. New Delhi.
4. Bose, T.K. and Yadav, L.P. 1989. Commercial Flowers Naya Praksh, Calcutta.
5. Carleton. R.M. 1959. Your lawn-How to make and keep it. D. Van Nostrand, Princeton, New Jersey.

6. Gorley. R.H.B., Hardon, J.J and W Wood, B.J. 1976. Oil Palm Research, Elsevier, Sci, Pub. Amsterdam.
7. Grindal, E.W. 1960. Everyday Gardening in India. D.B. Taraporenvalsa Sons, Bombay.
8. Havlerl, A.W. 1962. The Garden in the Plains. Oxford Univ. Press. London.
9. Kuck. L.E and Tongg, R.C. 1960. The Modern Tropical Gardens, Tongg. Pun, Honolulu.
10. Laurie, A. and Ries, V.H. 1950. Floriculure, Fundamentals and Practices. Mc Graw - Hil, New York.
11. Macmillan, H.F. 1962. Tropical Planting and Gardenning Macmillan, London.
12. iwk`, Gg.Gg. 1990, dz‡ji Pvl, evsjv GKv‡Wgx, XvKv|
13. Swarup, V. 1979. Garden Flowers, National Book Trust, New Delhi.
14. J. S. Arora. 1998. Introductory Ornamental Horticulture.3rd ed. Kalyani Publisher, Calcutta, India.
15. N. Roychowdhury & H.P. Mispra. 2001, Text Book on Floriculture and Landscaping. Shyamal Ghosh publishers.

CST. 204: CROP BOTANY–II

Plant Ecology

1. **Climate and Weather:** Concept, Climatic classification of World and Bangladesh and their influence on crops.
2. **Light:** Classification and distribution; factors affecting the quality and quantity of light penetration and absorption. Modification and regulation of light environment for the improvement of crop production.
3. **Temperature:** Global and seasonal distribution of soil and air temperature, plants response to the variation of temperature and methods to modify soil and air temperatures for the improvement of crop production.
4. **Water:** Significance of water to plants, hydrological cycling, forms of water and precipitation, evapotranspiration and energy relation, movement of water through soil-plant-atmosphere continuum. Causes and effects of droughts, dry-wind, dust, storms and hails on crop production.
5. **Wind:** Effects of winds upon vegetation, development of wind profiles over crop surfaces and their impact; modification of wind environment for the improvement of crop production.
6. **Micro and macro environment:** Concept, components, microclimate manipulation and improvement of crop production.
7. **Plant diversity and conservation:** Concept, causes of diversity losses, methods of conservation and management and nation conservation policy (NCP).
8. **Plant adaptation based on water requirement:** Hydrophytic, mesophytic, xerophytic and halophytic adaptations.
9. **Ecosystems:** Concept, structures, components, classification and functions of natural and cultivated ecosystems, flow of energy and matter, biogeochemical and nutrients cycling.
10. **Plant succession:** Causes, formation of vegetation, process and types of hydrosere, xerosere and lithosere.
11. **Phytogeography:** Principles, major vegetation regions of Bangladesh and World, Agro-Ecological Zones (AEZ) of Bangladesh and crop suitability.
12. **Biotic relation:** Types, interrelationship among biotic factors, vegetation and crop production, principles of crop-weed association.
13. **Environmental pollution:** Types, causes, atmospheric gases, their cycling and implications in agriculture, green house effects- causes and remedies, effects and control of environmental pollution, waste management.

Books Recommended:

1. Ambasht, R.S. and Ambasht, P.K. 1999. Environment and pollution. 3rd ed. CBS Pub., New Delhi.
2. Ambasht, R.S. 1978. A text book of plant ecology. Students, Friends & Co. Varanasi, India.
3. Chang, J.H. 1971. Climate and agriculture. Aldine Pub., Chicago.
4. Deshmukh, I. 1986. Ecology and tropical biology. Blackwell, Oxford.
5. Dimond, J. and Case, T.J. 1980. Community ecology, Harper & Row, New York.
6. Jackson, I.J. 1982. Climate, water and agriculture in tropics. Longman, London.
7. Kumar, H.D. 1995. General ecology. Vikas Pub. House, New Deldi.
8. Levit, J. 1980. Response of plants to environmental stresses, Academic Press, New York.
9. Odum, E.P. 1971. Fundamentals of ecology. Saunders, Philadel.
10. Rosenberg, N.J. 1985. Microclimate: The biological environment. John Wiley, New York.
11. Rosenberg, N.J.; Blad, B.L. and Verma, S.B. 1983. Microclimate: The biological environment. John Wiley, New York.
12. Shukla, R.S. and Chandel, P.S. 1998. Plant ecology. S. Chand and Co. Ltd. RamNagar, New Deldi.
13. 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.
14. Wilson, O.E. 1988. Biodiversity. Nat. Acad. Press, Washington, DC.

CST. 205: ENTOMOLOGY–I

Introductory Entomology, Taxonomy and Physiology of Insect

1. **Arthropoda:** General characters and classification. Onychopora; Crustacea, Arachnida, Trilobita; chilopoda, diplopoda, pauropoda, symphyla, insecta. Orders of insects, spiders, mites and their agricultural importance.
2. **Insect morphology:** An introduction to insect structures; external anatomy of grasshopper. Structures and functions of the insect integument. Various types of antennae, mouth parts and legs in insects. Modification of wings.
3. **Moulting and metamorphosis:** Definition and importance; types of metamorphosis; mechanism of moulting; types of larvae and pupae of insects.
4. **Internal anatomy and physiology:** Digestive system; excretory organs and excretion, Circulatory system; haemolymph and its functions; circulatory organs and mechanism of circulation.
5. **Respiratory system:** respiration in terrestrial insects; respiration in aquatic and endo parasitic insects.
6. **Nervous system:** central, peripheral and sympathetic nervous systems.

Books Recommended:

1. Essing, E.O. 1942. College Entomology. Macmillan Co., New York.
2. Imms, A.D. 1957. General Textbook of Entomology. Methuen & Co., London.
3. Ross, H.H. 1965. A Textbook of Entomology. John Wiley, New York.
4. Patton, H.R. 1963. Introductory insect physiology, Saunders, Phila.
5. Borror, D.J.,D.M. Delong and C.A. Triplehorn. 1976. An Introduction to the Study of Insects.
6. Chapman, R.F. 1982. The Insect Structure and functions. ELBS.
7. Comstock, J.H. 1957. An Introduction to Entomology. Comstock Public. Co. Inc. Ithaca, New York.
8. Singh, H. Household and Kitchen Garden Pests- principles and Practices. Kalyani Publishers. New Delhi, Calcutta.
9. †nv‡mb, Gg. Ges Avi. ingvb, 1984, D”PZi KxUZË¡, evsjv GKv‡Wgx, XvKv|

10. Hossain.M. and R.Rahman, 1785. An Introductory to Apterygote and Exopterygote Insects (in Bangali). Bangla Academy.
11. ingvb, Avi. Ges Gg. †nv‡mb, 1985. ewntc¶j KxUcZ‡½i weeiYx, evsjv GKv‡Wgx, XvKv|
12. Roeder, K.D. 1963. Insect physiology. John Wiley, New York.
13. Snodgrass, R.E. 1935. Principles of Insect morphology. McGraw Hills Book. Co. New York.
14. Wiggles worth, V.B. 1967. The principles of Insect Physiology, Methuen & Co. London.
15. Richards, O.W. and R.G. Davis. 1976. Outlines of Entomology, Chapman and Hall, London.
16. gy¯—vwdRyi ingvb, KxUZË¡, cÖ_g LÛ, †gvnv¤§` Be^{a}vnxg, 1984, evsjv GKv‡Wgx, XvKv|
17. gy¯—vwdRyi ingvb, KxUZË¡, wØZxq LÛ, ekxi Avj †njvj, 1983, evsjv GKv‡Wgx, XvKv|

CST. 206: PLANT PATHOLOGY–I

Introduction to Plant Pathology and its history.

Concept, Causes and Significance of Plant diseases with special reference to Bangladesh. Different types of disease symptoms and sign.

Introduction to fungi:

General characteristics of fungi including morphology, reproduction and nutrition, nomenclature and classification of fungi. Study of the following genera including their families and orders: *Synchytrium, Pythium, Phytophthora, Peronospora, Albugo, Rhizopus, Saccharomyces, Penicillium, Aspergillus, Erysiphe, Claviceps, Puccinia, Ustilago and Agaricus.*

Detailed study of the orders, families and genera of Deuteromycotina.

Introduction to Bacteria: General morphology, reproduction and nutrition, infection process, classification of plant pathogenic bacteria, symptoms of bacterial diseases with examples.

Introduction to Plant Viruses and Mycoplasmas: Nature of viruses, physical and chemical structures, infection process and replication, transmission, identification and classification of viruses; viroids and mycoplasmas.

Introduction to Plant Parasitic Nematodes: Morphology, anatomy, physiology with special emphasis to feeding and reproduction; classification of plant parasitic nematodes, symptoms of nemic diseases with examples.

Plant diseases caused by parasitic phanerogams: *Cuscuta, Loranthus and Orobanche.*

Books Recommended:

1. Alexopoulos, C.J. 1962. Introductory Mycology. John Wiley & Sons. Inc. N.Y.
2. Bawden, F.C. 1964. Plant Viruses and Virus diseases. The Ronald Press.
3. Christensen, Cm. 1961. The Molds and Man: An Introduction to Fungi. University of Mennesota Press,
4. Christie, J. R. 1959. Plant Nematodes: Their Dynamics and Control. Florida Agricultural Experimental Station, USA.
5. Corbett, J. K. and H. D. Sister (Ed) 1964. Plant Virology. University of Florida Press. Gainsville.
6. Emerson, F. 1946, Microbes Militant: A challenge to Man: The Ronald Press Company.
7. Goto, M. 1996. Fundamental of Bacterial Plant Pathology. Academic Press Inc. Tokyo.
8. Jenkins, W. R. and D. P. Taylor, 1967. Plant Nematology. Reinhold Pub. Corp. N.Y. Amsterdam and London.
9. Mathews, R.E.F. 1991. Plant Virology. Third Edition. Academic Press. INC. 1250 Sixth Avenue, San Diego, California, USA.
10. Mehrotra. Brahm Swarlep. 1967. The Fungi. 2nd ed. Oxford & IBH Publishing Co., New Delhi.

11. Mundkur. B. B 1964. Fungi and Plant disease MacMillan & Company. London.
12. Pelezar. M. J. I. Jr. and R. D. Reid. 1950. Microbiology. McGraw- Hill Book, Company, New York.
13. Rangaswami, G., 1972. Diseases of crop Plants in India. Prentice Hall of' India Private Ltd.
14. Singh, R. S. 1973. Plant Diseases. 3rd ed. Oxford & IBH.
15. Stakman. E. C. and J. C. Harrar, 1957. Principles of Plant Pathology. The Ronald Press Company, New York.
16. Stavenson, G. 1967. The Biology of Fungi. Bacteria and Viruses.
17. Thiman, K. V. 1966. The life ofBacteria.The MacMillan Co.
18. Thome, G. 1961. Principles of Nernatology. MacGraw-Hill Book Co., N. Y.
19. Webster, J. 1990. Introduction to Fungi. Third Edition. Cambridge University Press, Cambridge.
20. Weidel, W. 1959, Virus. The University of Michigan Press.

CST. 207: GENETICS AND PLANT BREEDING–I

Cytology and Cytogenetics:

1. Plant cell constituents of genetic importance.
2. Principal events of mitosis and meiosis in diploid organisms.
3. Morphological structure of eukaryotic chromosomes and their nomenclature, Prokaryotic chromosomes and their characteristics.
4. Euchromatin, heterochroniatin, allocycly and heteropycnosis.
5. **Special types of chromosomes:** Polytene chromosome, Lambrush chromosome, B-chromosome, Sex chromosome, Iso-and Telocentric chromosomes, Diplo chromosome.
6. Effects of different types of physical and chemical agents on chromosomes.
7. Karyotype: Characteristics, variation and its role on speciation.
8. Chemical organisation of chromosomes.
9. Structural changes of chromosomes, their meiotic behaviour and cytogenetic consequences.
10. Numerical changes of chromosomes, their meiotic behaviour and cytogenetic consequencs.
11. Genome and individual chromosome identification using autoradiography, microspectrophotometry, banding and in *situ* hybridization.
12. Cytognetics of wheat in relation to:

a) Origin and distribution of the polyploid wheats and related species.

b) Genomic relationship of the phylogenetically related species.

Genetics:

1. **Introduction:** Historical background, development and scope of genetics.
2. **Physical basis of heredity:** Chromosome theory of inheritance; experimental evidence for genes situated on chromosomes.
3. **Mendel's laws of inheritance:** Mendel and his experiments; Law of segregation and independent assortment.
4. **Modifications of Mendel's monohybrid and dihybrid F_2 phenotypic ratios:** Modifications due to allelic and nonallelic gene interaction.
5. **Linkage and crossing over:** Concept; mechanism and theories of crossing over; factors affecting crossing over, Mendel's second law is limited to linkage, absence of crossing over in male drosophilla, significance of linkage and crossing over; genetic map using three - point test cross progeny.

6. **Gene:** Classical and modern concepts; evidence of DNA as the genetic material; chemical composition of DNA and RNA, difference between DNA and RNA, Watson and Crick's model of DNA
7. **Mutation:** Concept, classification and characteristics of mutation; types of mutagenes and their effects; detection of mutation; molecular basis and significance of gene mutation.
8. **Male sterility:** Types, causes and inheritance of male sterility, transfer of male sterility to a new strain significance on hybrid seed.
9. **Self incompatibility:** Concept and types of self incompatibility with example.
10. **Apomixis:** Its types and application in crop improvement with example.
11. **Gene pool:** Genetic distance, homeostatis, polymorphism.

Books Recommended:

1. Bums G.W. 1980. The Science of Genetics 4th ed. Macmillan publishing co. Inc. New York.
2. Cytologia - International Journal of Cylogenctics and Cell Biology. 1998. Vol. 63 No. (1 -2).
3. Perry, J. and Appels. R. 1998. Chromosome structure and Function. Plenum press, New York and London.
4. Sharma. A. 1991. Chromosomes. Oxford & IBH Pub. Co. New Delhi.
5. Sharma. A. K. and Sharma. A. 1980. Chromosome Technique- theory and practice 3rd ed. Butterworthes, London.
6. Swanson, C.P; Merz. .J. and Young, W. J. 1988. Cytogenetics. The chromosome in Division, inheritance and evolution. Prentice Hail of India private Ltd.
7. Sybenga, J. 1977. General Cytogenetics. North Holland Publishing Co. Amstradam.
8. Verma, P.S. and Agarwal, V. K. 1998. Cytology. S. Chand & Co. Ltd. Ram Nagar, New Delhi.
9. Brown, W.V. 1972. A Text Book of Cylogenetics. C.V. Mosby Pub. , St. Loise, USA.
10. Burns, G.W. 1980. The Science of Genetics, 4th ed. Macmillan Publishing Co. Inc, New York.
11. Evan, LT. and Peacock, WJ. 1981(ed). Wheat science- today and tomorrow. Cambridge University Press, Cambridge, London.
12. Gupta P.K. 1987. Genetics 2nd ed. Rastogi Publication Meerut, India.
13. Gupta, A. K. 1977(ed). Proceedings of the National Seminar on Genetics and Wheat Improvement. Ludhiana, February, 22-23. 1977. Oxford & IBH Pub. Co, New Delhi.
14. Gupta, P.K. 1995. Cytogenetics. 1st. ed. Rastogi, India.
15. Gurdev, S. K. 1973. Cytogenetics of Aneuploids. Academic Press, Inc. New York.
16. Reitz. L. P. And Quais enberry. K. S. (ed.) 1967. Wheat and Wheat Improvement. American Society of Agronomy, Madison, Wisconsin.
17. Riley. H.P. 1967. Introduction to Genetics and Cytogenctics. I Hafner Pub. Co. Inc. New York.
18. Sharma. A. 1991. Chromosomes. Oxford & IBH Pub. Co. New Delhi.
19. Sharma. A. K. and Sharma. A. 1980. Chromosome Technique- theory and practice 3rd ed. Butterworthes, London.
20. Singh. B.D. 2001. Fundamentals of Genetics. 3rd . Ed. Kalyain Publisher, New Delhi-I 10002, India.
21. Sinnott. E.W.: Dunn. L. C. And Dobzhansky.T. 1973. Principles of Genetics McGraw-Hill Book Company, INC 5th edition.
22. Stansfield. W. D. 1991. Schaum's Outline of Theory and Problems of Genetics. McGraw-Hill, INC. 3rd edition.
23. Strickberger, M.W. 1990. Genetics. 3rd ed. Macmillan Publishing Co. New York.
24. Swanson, C. P. 1965. Cytology and Cytogenetics. McMillan and Co. Ltd. London
25. Swanson, C.P.; Merz. Y. And Young. W.J. 1987. Cytogenetics. Prentice Hall press. London.
26. Verma, P.S. and V.K. Agarwal. 1998. Genetics. 8th ed. S. Chand and Co. Ltd. New Delhi.

CST. 208: AGRICULTURAL EXTENSION–I

1. **Concept and meaning of agricultural extension:** Basic concept of extension and agricultural extension; objectives, phases, scope, functions, philosophy, principle, evolution of agricultural extension. Interrelationship of agricultural education, research and extension.
2. **Agricultural education:** Definition, objectives, types and principles of education. Adult education-definition, objectives and principles.
3. **Motivation and learning:** Concept of need, motivation, learning. Characteristics of need and importance of motivation extension work. Theories of need-Maslow, Hertzberg and McGregor. Elements in the learning process, theories of learning and laws of learning and their implication in extension work. Criteria for effective learning, special features of adult learning and principles of adult learning as applicable to agricultural extension.
4. **Leadership:** Definition, types, characteristics of leaders, qualities of a good leader, duties and responsibilities of professional and local leader, criteria for selection of local leader, different methods for identification of local leader, importance and recognition of local leader .
5. **Extension Service in Bangladesh:** Department of Agricultural Extension (DAE) and its development in Bangladesh. New Agricultural Extension Policy (NAEP) in Bangladesh-aims and components of NAEP.
6. **Basis of Human Behaviour:** Personality, behaviour, fatalism, frustration and its adjustment, attitude.
7. **Extension work for special interest group:**
   - Rural youth- youth, youthhood and rural youth, role of rural youth, rural youths in agricultural extension programmes and activities.
   - Rural women- role of rural women in agriculture, use of indigenous technologies by farm women, their empowerment, involvement of women in decision making process in family.
   - Landless farmers- concept of landless, present status and position, socio-economic situation of landless rural families, suitable agricultural activities and interest of landless families.
   - Target group- concept and features of target group, criteria for selecting a target group

Books Recommended:

1. Chambers, R. 1983. Rural Development - Putting the Last First,. Longmans, London.
2. Chitambar, J. B. 1973. Introductory Rural Sociology. Willy Sastern, Delhi.
3. DAE. 1996. Agricultural Extension Manual. Department of Agricultural Extension. Ministry of Agriculture. Govt. of the Peoples. Republic of Bangladesh.
4. Dahama, O. P. 1978. Extension and Rural Welfare. Ramprasad and Sons. Agra.
5. wgqv, Gg.G.we. 1992, mgvRweÁvb, †M-ve jvB‡e^{a}ix, XvKv|
6. Singh, K. 1985. Rural Society. Proakashan Kendra, Luknow.
7. Sunderson, D. 1948. Rural Sociology and Rural Social Organization. Joh Willy and Sons, New York.
8. Swaminathan, M.S. 1982. Science and Integrated Rural Development, Concept Pub. Co. New Delhi.

CST. 209: BIOCHEMISTRY–II

Biochemistry and Metabolism

1. **Carbohydrates:** Physical and chemical properties, stereo isomerism, chemistry of monosaccharides, disaccharides and polysaccharides with special reference to starch, cellulose and cell wall polysaccharides. Color reactions of carbohydrates.
2. **Proteins:** Physical and chemical properties. Amino acid composition of protein and peptides. Reactions of amino acids. Amino acid as ampholytes, isoelectric point. Protein structure.
3. **Lipids:** Physical and chemical properties. Fatty acid composition of fats. Characterization of fats, oils and waxes. Phospholipids with special reference to lecithin and cephalin.
4. **Enzyme:** Definition, classification and chemical nature of enzyme. Concept of coenzymes and prosthetic groups. Mode of action of enzymes and factors affecting their reactions.
5. **Nucleic acid:** Occurrence, composition classification, structure, chemical and physical properties. Functions of nucleic acids.

Metabolism:

6. General aspects of metabolism, study of intermediary metabolism.
7. **Carbohydrate metabolism:**
    a. Glycolysis. Aerobic and anaerobic fate, metabolism of disaccharides, pentoses, hexoses other than glucose. Physical importance of aerobic and anaerobic glycolysis. ATP synthesis.
    b. Tricarboxylic acid cycle. Amphibolic nature and anapleurotic reactions of TCA cycle. ATP synthesis.
    c. Pentose phosphate pathway and glyoxylate pathway.
    d. Glycogen metabolism: Glycogenolysis, glycogenesis.
8. **Lipid metabolism:** Degradation of triglyceride and phospholipids, oxidation of saturated and unsaturated fatty acids. Propionate metabolism.
9. **Protein metabolism:** Outline of amino acid metabolism, decarboxylation, oxidative deamination, trasamination, metabolic fates of amino groups, urea cycle, toxicity of ammonia.

Books Recommended:

1. Albanese, A.A. 1980. Principles of Biochemistry. Worth Pub. Piladelphia.
2. Burton B.T. 1976. Human Nutrition, 3rd ed. Tata McGraw Hill, New Delhi.
3. Conn. E.E and Stumpf, P.K. 1984. Outline of Biochemistry, 5th ed. John Wiley and Sons, New York.
4. Lehninger. A.I. 1980. Principles of Biochemistry. Worth Pub. Philadelphia.
5. West and Toad. 4th edition, 1974. Text Book of Biochemistry, Oxtord & IBH Pubishing Co.Pvt. Ltd.
6. Street. 1967. Plant Metabolism, Pergam Press. London.
7. Dev. A.C. 2006. Fundamentals of Biochemistry. 8th edition, New Central Book Agency (P) Ltd. Kolkata.

CST. 210: AGRICULTURAL STATISTICS–I

Principle of Statistics

1. Definition and scope of statistics, Origin and historical development of statistics, Variable, Different types of variables. Frequency distribution; construction and graphical representation of data with numerical example.
2. Central tendency, Measures of central tendency. Dispersion, Measures of dispersion. Moments, Skewness and Kurtosis with numerical example for each case.
3. Random experiment, outcome, sample space, events, union and intersection of events with venn diagram, mutually exclusive, equally likely, independent and dependent events. Definition of probability, conditional probability. Additive and multiplicative laws of probability.
4. Random variable, probability distribution. Derivation, properties and uses of binomial distribution, poisson and normal distribution.
5. Simple correlation, scatter diagram, the Pearson's correlation coefficient. Properties of correlation coefficient.
6. Regression and regression coeffcients. Least squares method for fitting regression line. Properties of regression coefficients. Distinguish between correlation and regression.
7. Path analyses.

Books Recommended:

1. Shill, R.N, & S.C. Debnath, 1992. An Introduction to the Theory of Statistics (2/e), Computer Compose by Confidence Computer, 385, Sirajuddowlla Road. Chittagong.
2. Ali, M.A. 1969, 1973. Theory of Statistics (Vol. 1&2) Dhaka Book Mrt, Dhaka.
3. Chatterjee, S. & Price, B. 1981. Regression Analysis by Example, John Wiley, New York.
4. Draper, N.R. & Smith, H. 1981. Applied Regression Analysis, John Wiley, New York.
5. Mostafa, M.G. 1976. Methods of Statistics (2/e), Anweri Publications, Dhaka.
6. Kapur, J.N. & Saxena, H. 1976. Mathematical Statistics, S. Chand and Company Ltd., Ramnagar, New Delhi.
7. Gupta, S.C. & Kapoor, V.K. 1982. Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi.
8. Goon, A.M. & Gupta, M.K. 1979. Fundamentals of Statistical Theory. Vol. 1, 2, 3 World Press Pvt. Ltd, Calcutta, India.
9. Goulden, G.H. 1952. Methods of Statistical Analysis, John Wiley, New York.
10. Yule, G.U. & Kendall M.G. 1965. An Introduction to the Theory of Statistics. Charles Griffin, London.
11. Goldstein, A. 1968. Biostatistics, An Introductory Text. MacMillan New York.
12. Gomez, K. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Reseach. 2nd edn, John Wiley and Sons. Inc. New York.
13. Lewis, A. 1971. Biostatistics. East West Press, New Delhi.
14. Steel, G.D. and Torric, J.H. 1960. Principles and Procedures of Statistics, MacGraw Hill Book Co. Inc. New York.
15. Dr. A. Rashid Ahmed, M.A.A. Bhuiya and Z.A. Reza, M.Z. Hossain. 2004. Methods of Statistics. S. Ahmed & Associate, 59, Shahid Sarani Sarak, North Seota, Manikganj-1800.

CST. 211: AGRICULTURAL CHEMISTRY–I

Fundamentals of Agricutural Chemistry

1. **Essential plant nutrient elements:** Macro, Micro nutrients, (Primary and secondary elements) and their role (important) on growth and development of plants.
2. **Fertilizer Concepts:** Feed stocks and classification of fertilizers. Physical and chemical properties of fertilizers.
3. Secondary and micronutrient fertilizers; mixed, compound and liquid fertilizers. Advantages and disadvantages of mixed and liquid fertilizers. Controlled release fertilizers. Fertilizer tables for pot culture. Compatibility of fertilizers. Fertilizer effects on environment and its measures. Comparison of commonly used nitrogenous, phosphatic and potassic fertilizers.
4. **Manufacturing of fertilizers:**

   Nitrogenous fertilizers: Raw materials, Synthesis of ammonia and carbondioxide, production of urea.

   Phosphatic fertilizers: Phosphatic rocks, sulphuric acid manufacture, phosphoric acid manufacture, production of OSP, TSP and DAP.

   Potassic fertilizer: Types and composition of potash ores, manufacture of potassimm chloride.
5. **Pesticide formulation:** Chemistry of pesticide formulation, chemistry and utilization of auxiliary materials for insecticide, fungicide and herbicide formulations; dust carriers, solvents, emulsifiers. Spreaders, wetting and dispersing agents, sticker's stabilizing agents. Preparation of granulate, fumigant, lignified gas aerosol. Micro encapsulation, Synergists.
6. **Bio gas and organic wastes:** Concept of biogas, Historical developments of biogas technology in Bangladesh. Production of biogas from organic wastes. Utilization of sewage-sludge and biogas effluent.
7. **Water chemistry:** Sources, quality assessment and criteria for drinking, irrigation, poultry, livestock, aquaculture and industrial usages of water, ionic toxicity and plant tolerance, characteristics of water bodies, chemical models of water system and water treatment.

Books Recommended:

1. Collings, G.H. 1955. Commercial. Fertilizers their sources and use. McGraw Hill, New York.
2. Cooke, G.W. 1982, Fertilizing for Maximum Yield. ELBS London.
3. Das, R.K. 1987. Industrial Chemistry. Part 2. Kalyani Pub., Ludhiana.
4. Hignett, T.P. 1985, Ferilizing Manual. Lntl. Fertilizer Pex. Center (IFDC), Alabama.
5. Jain, B.K, and Sivashannkaran, V.S. 1992. Handbook of Fertilizer Technology. Fertilizer Assoc. India, New Delhi.
6. Mc Vickeri M.H., Bridger, G.L. and Nelson, L.V. 1963. Fertilizer Technology and Usage. Soil Sci. Soc, Amer., Wisconsin.
7. Ramulu, U.S.S. 1985. Chemistry of Insecticides and Fungicides. Oxford and IBH Pub., New Delhi.
8. Tisdale, S.L Nelson, W.L and Beaton. J.D. 1985. Soil Fertility and Fertilizers. Macmillan. Pub. Co., New York.
9. Trivedi, R.N., Chari, K.S and Pachaiyappan, V. 1979. Pollution Control in Fertilizer Industry. Part L. Liquid Effluents. Fertilizer Assoc. India., New Delhi
10. Valkenburg, W.V. 1973. Pesticide Formulations. Marcel Dekker, New York.
11. Worthing, C.R 1987. The Pesticide Manual, British Crop Protection Council, London.

PRACTICAL COURSES

B.Sc.Ag. (Hons) Part-II

CST. 212: AGRONOMY–II

1. Identification of seed of field crops and preparation of a seed album.
2. Study of structures of monocotyledonous and dicotyledonous seeds and their appendages.
3. Techniques of seed sampling
4. Moisture test of seed
5. Purity test of seed
6. Viability test of seed
7. Germination test of seed
8. Vigour test of seed
9. Calculation of seed rate of crops.
10. Practicing seed treatment
11. Growing seed crop in students' individual plots.
12. Identification of weeds and weed seeds/propagules and preparation of weed herbarium.
13. Study of life cycle and morphology of major weeds- (a) grass (b) sedge (c) broadleaf weeds and (d) pot culture.
14. Identification of herbicides and their physical characteristics.
15. Calibration of a sprayer
16. Herbicide calculation.
17. Spraying of non-selective, pre-emergence and post-emergence herbicides in crop field to study their effect on crop and weed

CST. 213: HORTICULTURE– II

1. Field visit for identification of horticultural crops (flowers, ornamental plants, cacti, fern, orchid and their seeds) in different areas of Bangladesh and preparation of album.
2. Propagation practices of important ornamental plants and flowers
3. Study on planning and design of an ideal home garden
4. Graphics design and modelling of park, rock garden, water garden, Japanese garden and road side plantation.
5. Cultivation practices of ornamental plants in individual plot
6. Cost benefits analysis of important commercial flowers.

CST. 214: CROP BOTANY–II

1. Introduction to adaptive features of different ecological plant types e.g. mesophytes, xerophytes, hydrophytes, halophytes, heliophytes and sciophytes.
2. Study on biotic related plants-commensals, ammensals, parasites, symbionts etc.
3. Methods of ecological survey of plant communities and field study of plant habitats.
4. Experiments on flow of energy in agro-ecosystem on light, heat transfer and radiant energy.

5. Experiments on crop-weed association, mulches, and their effects on crop production.
6. Field visit to different Agro-Ecological Zones (AEZ) of Bangladesh.

CST. 215: ENTOMOLOGY–I

1. Techniques of preparation of temporary and permanent slides of antennae, mouthparts, legs, wings and scales of insects.
2. External morphology of grasshopper, various types of antennae, legs, mouthparts and wings of insects.
3. Study of morphology and various systems of grasshopper, cotton bug and lepidopterous insect.

CST. 216: PLANT PATHOLOGY–I

1. Calibration of microscope and measurements of plant pathogens.
2. Techniques involved in preparation of slides for microscopic study.
3. Preparation of culture media.
4. Sterilization: Methods and techniques.
5. Isolation and detection of fungi, bacteria and nematodes from diseased plant materials and soil.
6. Isolation, detection and inculation of viruses from diseased plant materials
7. Study of the following genera of fungi:
8. *Synchytrium, Pythium, Mucor, Rhizopus, Aspergillus, Penicillium, Agaricus, Alternaria,, Curvularia, Pyricularia, Fusarium, Rhizoctonia* and *Sclerotium*,
9. Demonstration of different types of symptoms of plant diseases.

CST. 217: GENETICS AND PLANT BREEDING–I

1. Study of mitosis in onion root tip cells.
2. Study of meiosis in the pollen mother cells of onion/maize.
3. Effect of colchicine treatment on onion/garlic root tip chromosomes.
4. Effect of gamma-ray irradiation on onion/garlic root tip chromosomes.
5. Introduction to practical genetics: Demonstration and maintenance of parents, F_1 and F_2 generation plants in the Genetics and Plant Breeding experimental farm.
6. Problems on monohybrid cross: Complete dominance, partial dominance and co-dominance.
7. Problems on dihybrid cross: Complete dominance, partial dominance and co-dominance.
8. Problems on trihybrid cross: Complete dominance.
9. Problems on gene interaction: Non-epistatic and epistatic gene interaction.
10. Problems on linkage and crossing over: Using two and three-point test cross.

CST. 218: AGRICULTURAL EXTENSION -1

1. Presentation of basic facts about Bangladesh agriculture.
2. Acquaintance with the of works of extension organizations related to agricultural development
3. Farm and home visits.
4. Delivering talk (Lecturing): Practice of delivering talk on assigned topic.
5. Methods of collecting data.
6. Preparation of questionnaire.
7. Procedure of interviewing.
8. Small group discussion techniques: Brainstorming, Role playing and Phillips 66 procedure and practice.
9. Visit to selected farm/Agricultural Research Institute/ Non Government Organization of agricultural importance.

CST. 219: AGRICULTURAL CHEMISTRY–I AND BIOCHEMISTRY–II

A) Agricultural Chemistry–I

1. Instructions for writting laboratory books and use of laboratory chemicals, glasswares, and their safety measures.
2. Operation of laboratory equipments a) pH meter, b) Electrical conductivity meter, c) Spectrophotometer, d) Flame emission spectrophotometer and e) Atomic absorption spectrophotometer.
3. Analytical techniques: Analytical techniques of titrimetry, colorimetry, flame emission, atomic absorption spectrophotometry and chromatography.
4. Production of biogas from agrowastes.
5. Chemical analysis of cowdung and biogas effluents.
6. Application of biogas effluents on field crops.

B) Biochemistry–II

1. Preparation of buffer solutions and determination of their pH.
2. Color test for carbohydrates and proteins.
3. Estimation of protein, fats and starch in plant samples.
4. Solubility test for fats.
5. Paper chromatographic separation of amino acids and sugars.
6. Quantitative estimation of thiamin and ascorbic acid in plant sample.
7. Determination of shaponification value and iodine value of fats.

THEORY COURSES

B.Sc.Ag. (Hons) Part-III

CST. 301: AGRONOMY–III

1. **Crop growth and development:** Concept of growth and development different growth phases and stages of rice and wheat plants. Factors affecting growth, development and yield of crops.
2. **Water Management:** Water use efficiency under irrigated farming. Water management in rainfed/dryland farming. Irrigation scheduling.
3. **Fertilizer Management:** Balanced fertilization. Fertilizer management in relation to varietal characteristics, growth phases, cropping systems and irrigation.
4. **Organic Matter Management:** Maintenance and replenishment of organic matter in soil. Concept of organic farming.
5. **Management of Stress:** Moisture, drought and flood; cold, heat, salinity and alkalinity stress and their management for crop production.
6. **Production Technology of Crops:** Origin, climate and soil requirements, characteristics of species, sub species and cultivars, cultivation practices, post-harvest operations and cost of production of the following crops:

   a) **Cereal crops:** Rice, wheat, maize, barley and millets.

   b) **Sugar crops:** Sugarcane and sugarbeet.

   c) **Pulse crops:** Lentil, mungbean, grasspea, pea, chickpea, pigeonpea and blackgram.

   d) **Narcotic crops:** Tobacco.

   e) **Green manuring crops:** *Dhaincha,* sunnhemp and cowpea.

   f) **Legume species:** Dhaincha, berseem, cowpea, clovers and sunnhemp.
7. **Cropping Systems:** Concept and determinants.
   a) **Multiple cropping:** Objective, types, advantages and disadvantages. Factors affecting the selection of species combination–Principles & Practices.
   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.
8. **Crop Calendar:** Objectives, utility, procedure of preparation.
9. **Special Cropping Systems:** Rice-fish systems: alternate and Simultaneous, importance and scope. Rice Culture under the rice-fish systems- technology and management.

Books Recommended:

1. Arakeri. H.R. and Donahue, R. 1988. Conservation and Water Management Oxford and IBH Pub. Co. Pvt. Ltd Calcutta, Bombay and New Delhi. India.
2. Kipps, M.S. 1978. Production of Field Crops. 6th Edition. Tata McGraw-Hill Publishing Company Ltd. New Delhi, India.
3. Martin, J.H.; Leonard, W.H. and Stamp, D.L. 1976. Principles of Field Crop Production. 3rd Edn, McMillan Pub., New York.
4. Mudaliar. V.I.S. 1984. Principles of Agronomy. 5th Edition. The Bangalore Printing and Pub., India.

5. Seizwo, M. 1967. Crop Science in Rice. Theory of Yield Determination and its application. Fuji Pub. Co. Tokyo,
6. Shyte, R.O. 1980. Crop Production Environment. Faber and Faber Ltd. 24, Russel Square, London, W.C.I.
7. Thakur, C. 1979. Scientific Crop Production. Volume I and II. 3rd Edition. Metropolitan Book Co. Ltd. I. Netaji Subhash Maeg, New Delhi 11002, India.
8. Yawalkar, K,S.; Agarwal, J.P. and Bokde, S.1981. Manures and Fertilizers. Agri-Horticulture Pub.. Nagpur-440010, India,
9. Beets, C.W. 1983. Multiple Cropping and Tropical Farming Systems. Westview Press.
10. 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.
11. Francis. C. A. 1986. Multiple Cropping System. Macmillan Publishing Co. New York.
12. 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.
13. Spedding, C,R.W. 1988. An Introduction to Agricultural Systems (2nd Ed.). Elsevier Applied Science. London, NewYork.
14. Zandstra. H.G.; Price, L. and Morris, R.A. 1981. A Methodology for On-farm Cropping Systems Research. IRRI. Los Banos Philippines.

CST. 302: SOIL SCIENCE–III

Soil Chemistry and Microbiology

1. **Soil reaction:** Soil pH, forms of H^+ ion in soil, grading of soil according to pH values, sources or causes of soil acidity, role of p^H on nutrient availability, problems of soil acidity. Acid sulphate soil–formation, location and extents in Bangladesh, classification, characteristics and management.

2. **Liming:** Principles of liming reactions, factors affecting liming reactions, kinds of liming materials, efficiency of liming materials, neutralizing index, chemical reactions between liming materials and acid soils, lime requirement and liming factors, methods of appling, lime balance sheet, effect of overliming, role of lime on soil properties. Some problems about estimating lime requiments.

3. **Soil colloids and clay mineralogy:** Nature and important properties of soil colloids, types of soil colloids; concept of silicate clays, structure of layer silicate clays–structural units; 1:1 type, 2:1 types and 2:2 types of mineral, comparative properties of important silicates clays. Concept of buffering capacity of soil.

4. **Ion exchange:** Definition, caption and anion exchange, origin of ion exchange, causes of negative charge on soil colloids, CEC, BSP and milliequivalent, factors affecting CEC and importance of CEC. Factors affecting and importance of anion exchange. Concept of contact exchange and root CEC.

5. **Submerged soils:** Definition, kinds, difference between aerated and sub-merged soils, characteristics of submerged soil, Redox potential and factors affecting redox potential, sequentional reduction reactions, transformation of N, P, K, S, Fe and Zn; CH_4 formation and impact on environment.

6. **Saline and alkaline soils:** Saline soil–definition, characteristics, formation, classification, location and extents, management of saline soils; saline tolerance crops. Alkaline soils–definition, properties of alkaline soils, concept of calcareous soils, and management of alkaline soils.

7. **Soil organisms:** Classification; concept of Protista, Procarotes and Eucariotes; classification of Bacteria and Algae; occurrence and functions of Bacteria, Fungi, Algae, Protozoa and Earthworms. Concept on Mycrrhizal Symbiosis.

8. **Biological Nitrogen Fixation (BNF):** Definition, agents, symbiotic and non symbiotic N-fixation. Legume-rhizobium symbiosis, cross inoculation group and legume crops. Azolla-anabaena symbiosis, importance and limitations in Bangladesh. Blue-green algae (BGA)-ecology, Physiology, importance and methods of production. Factors affecting Azolla and BGA growth.

Books Recommended:

1. Black, C. A. 1973. Soil Plant Relationship. Wiley Eastern Private Ltd. New Delhi.
2. Chhabra, R. 1996. Soil Salinity and Water Quantity. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi, Calcutta.
3. De, G. C. 1998. Fundamentals of Agronomy. Oxford and IBH Pub. Co. Pvt. Ltd. Calcutta.
4. Mudaliar, V. T. S, 1984. Principles of Agronomy. Bapp. Co. Bangalore.
5. Alexauder, M. 1977. Introduction to Soil Microbiology. John Wiley and Sons. New York.
6. Allen, D. N. 1949. Experiments in Soil Bacteriology. Burgers Pub. Co. Minneapolis.
7. Allen, E. N. and Allen, O. N. 1981. The leguminosae. A Source Book of Characteristics, Uses and Nodulation. The University of Wisconsin Press, Madison.
8. Burris, R. H. 1974. Methodology. In The Biology of Nitrogen Fixation. Ed. A. Quispel North Holland Pub. Co. Amsterdam.
9. Burton, J. C. 1967. *Rhizobium* Culture and Use. In Microbial Technology. Ed. H. J. Peppler, Reinhdd Pub. Corp. New York.
10. Harley, J. L. and Smith, S. E. 1983. *Mycorrhizal* Symbiosis, Academic Press, New York.
11. Marks, C. G. and Koslowski, T.T (eds.) 1973. *Ectomycorrhizae* - Their Ecology and Physiology. Academic Press, New York.
12. Subba Rao, N. S. 1977. Soil Microorganisms and Plant Growth. Oxford and IBH Pub. Co. New Delhi.
13. Subba Rao, N. S. 1979. Recent Advance in Biological Nitrogen Fixation. Oxford and IBH Pub. Co. New Delhi.
14. Subba Rao, N. S. 1995. Biofertilizers in Agriculture and Forestry. Oxford and IBH Pub. Co. New York.
15. Tisdale, S. L., Nelsone, W. L. and Beaton, J. D. 1990. Soil fertility and fertilizers. McMillan Pub. Co. New York.
16. Venkataraman, G. S. 1972. Algal Biofertilizers and Rice Cultivation. Today and Tomorrow Printer and Publishers, New Delhi.

CST. 303: HORTICULTURE – III

Production Technology of Vegetables and Spices

1. **Introduction to olericulture:** Definition and concept; discipline and its areas, classification and importance of vegetables and spices.
2. **Common vegetables in Bangladesh:** Nomenclature, morphology and growth habit
3. **Vegetable production in Bangladesh**: Background, present situation and associated problems, scope of development.
4. **Environmental factors affecting vegetable production:** Role of temperature, light, air, rainfall, humidity and soil on the growth and development of vegetable.
5. **Vegetable seeds and other propagating materials:** Present situation of vegetable seed production in Bangladesh: Production methods of important vegetable seeds, seed quality, seed vigor and factor affecting viability of vegetable seeds, storage of vegetable seeds, methods of vegetative propagation of some important vegetable crops in Bangladesh.
6. **Soil less production of horticultural plants**: Water culture (Hydroponics) and sand culture.
7. **Production practices of vegetable crops**: Tomato, Brinjal, Cabbage, Cucumber, Cauliflower, Radish, Lady's finger, Potato, Spinach, Watermelon, Pointed gourd, Lettuce, Sweet potato and Leafy vegetables.

8. **Production and processing of spices and condiments:** Onion, Garlic, Ginger, Turmeric, Chili, Cumin, Black pepper, Bay leaf, Cinnamon and Coriander.
9. **Vegetable farming:** Kitchen garden and commercial farming, organic farming, poly-tunnel production, inter, multiple and relay cropping, crop rotation of vegetables and spices: principles, advantages and schedulling of crop rotation

Books Recommended

1. Katyal, S.L. 1977. Vegetable Growing in India, Oxford & IBH Pub. Co., New Delhi, India.
2. iwk`, Gg.Gg. 1983, mewRi Pvl, †eMg mvqjv iwk`, evwi AvevwmK GjvKv, Rq‡`ecyi, XvKv|
3. kidzwÏb, G.Gd.Gg. Ges Gg.G. wmwÏK, 1985, mwâ weÁvb, wg‡mm nvwmbv AvKZvi weDwU, weGBD, gqgbwmsn|
4. Thompson, H. C. and W.C. Kelly. 1957. Vegetable Crops. McGraw Hill Book Cp. Inc. New York.
5. Prasad, S. and U. Kumar.1999. Principles of Horticulture. Agrobotanica. 4E 176 Jn. Vyas Nagar, Bikaner, India.
6. Jules Janick.1982.Horticultural Science.Surjeet Publications, 7k, Koihapur, Kamla Nagor, New Delhi.
7. J. B. Edmiond et al. Fundamentals of Horticulture. Tata McGraw-hill Publishing Co. ltd. New Delhi.
8. ivgvb›` PµeZx©, 1999, D`¨vbweÁvb Ges dj I mwâ msMÖn, Z…Zxq ms¯‹iY, cwðg evsjv, fviZ|
9. P. Hazra and M. G. Som.1999. Technology for Vegetable Production and Improvement. Naya Prokash, 206 Bidhan Sarani, Culcutta, India.

CST. 304: CROP BOTANY–III

Plant Physiology

1. **Plant water relationship:** Concept and measurement of water potential, absorption mechanisms, path of absorption and water movement, factors affecting absorption, theories of ascent of sap, water loss phenomena in leaf and other plant parts, mechanism of opening and closing of stomata, stomatal movement, factors affecting stomatal movement and transpiration.
2. **Photosynthesis:** Photosynthetic apparatus, light and dark respirations, photosynthetic pathway and their significance, factors essential for photosynthesis.
3. **Respiration:** Concept, types, mechanisms, importance, relationship of carbohydrate metabolism to other compounds, factors affecting respiration, controlling measures for photorespiration, relationship between respiration, growth and storage of plant products.
4. **Growth regulators:** Concept, classification, effects of phytohormones (auxin, gibberellins, cytokinins and others) on growth and development with special reference to agricultural crops.
5. **Seed physiology:** Structure and chemical composition, sources of assimilate and maturation, stored seed reserves and its control: dormancy- causes and mechanisam.
6. Growth and development: Concept, factors affecting growth, determinate and indeterminate growth, growth correlation and growth dynamics, vegetative and reproductive growth, plant growth and yield analysis techniques.
7. Photoperiodism and vernalization: Concept, process, mechanism and application to agriculture.
8. Stress physiology: Types, nature of injury, causes, mechanisms and survival measures to overcome.

Books Recommended:

1. Bewley, J.D. and Black, M. 1994. Seeds: Physiology of development and germination. 2nd ed. Plenum Press, New york.
2. Datta, S.C. 1994. Plant physiology. Wiley Eastern Ltd., Calcutta, India.
3. Devlin, R.M. and Witham, F.H. 1977. Plant physiology. 4th ed. CBS Pub. & Distributors. New Delhi.
4. Fosket, D.E. 1994. Plant growth and development. Academic Press Inc. California.
5. Gardner, F.P., Pearce, R.B. and Mitchell, R.L. 1985. Physiology of crop plants. Lowa State Uni. Press, USA.
6. Hall, D.O., Scurlock, J.M.O., Bolhar-Nordenkampf, 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.
7. Hans, M. 1984. Class experiments in plant physiology. George Allen & Unwin Pub. Ltd., London.
8. Hunt, R. 1982. Plant growth curves: The functional approach to plant growth analysis. Edward Arnold, London.
9. Levit, J. 1980. Response of plants to environmental stresses. Academic Press, New York.
10. McDonald, M.B. and Copeland, L.O. 1989. Seed science and technology: Laboratory manual. Iowa State Univ. Press, USA.
11. Mohr, H. and Schopfer, P. 1994. Plant physiology. Springer, Berlin.
12. Nilsen, E.T. and Orcutt, D.M. 1996. The physiology of plants under stress. John Wiley and Sons, Increased., New york.
13. Pandey, S.N. and Sinha, B.K. 1972. Plant physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
14. Purohit, S.S. 1990. Aspects of Physiology & Bio-chemistry of Plant Hormones. Kalyani Pub. New Delhi.
15. Salisbury, F.B. and Ross, C.W. 1986. Plant physiology. Wadworth Pub., USA.
16. Weaver, R.J. 1981. Plant growth substances in agriculture. S. Chand & Co. Ltd. New Delhi.

CST. 305: ENTOMOLOGY–II

Systematic Entomology, Insect Embryology and Pest Management

1. **Systematic entomology:** Diagnostic characteristics of the important families of the orders: Thysanura, Odonata, Orthoptera, Dictyoptera, Thysanoptera, Isoptera, Hemiptera, Homoptera, Lepidoptera, Coleoptera, Diptera and Hymenoptera.
2. **Insect physiology:** Endocrine system, neuro secretary cells, carpora cardiaca, corpora allata and thoracic glands, types of hormones and their functions, Instar, sub-imago and imago. Hormonal control of metamorphosis.
3. **Insect Nutrition:** Nutritional requirements of carbohydrates, fats and proteins and their metabolism of insects.
4. **Insect reproduction and embryology:** Reproductive systems, spermatogenesis and ogenesis, types of reproduction. Development and formation of the embryo, segments and appendages.
5. **Pest and pest management:** Concept of pest and pest management. Agro-ecosystem, economic threshold, economic injury level and equilibrium position, outline of pest management. Biology, nature of damage and control measures of major insect pests of vegetables, fruits and stored products.
6. **Introduction to IPM:** Interactions and compatibility of different tactics of pest management and cost benefit analysis, synthesis of IPM system. Organization and implementation of IPM.

Books Recommended:

1. Atwal, A.S. 1976. Agricultural pest of India and Southeast Asia. Kalyani Publishers, New Delhi.
2. Flint M.L. and Van deu-Boseh.R. 1981. Intorduction to integrated pest management. Plenum Publ. Crop. New York.
3. Price, P.W. 1984. Insect Ecology (Second ed.) John wiley and sons, New York.
4. Dent, D. Insect Pest Management. CAB International. Inite Kingdom.
5. Evans, J.W.1987. Insects Pests and Their Control. Sony Reprints Agency. New Delhi.
6. Metcalf, R.L. and W.H. Luckman. 1994. Introduction to Insect Pest Management. Intercept Ltd. Hampshire.

CST. 306: PLANT PATHOLOGY–II

Diseases of field crops

1. **Pathogenesis:** Parasitism and pathogenicity, chain of events in disease development. Enzymes and toxins in disease development, pathogenic effects on physiological functions of plants.
2. **Dissemination of plant pathogens:** Importance, factors and mechanism, disease development, predisposition.
3. **Epidemiology:** Concept of epidemiology and epiphytotic, types of epidemic, components of epiphytotic: Host, pathogen, time, human and their role in disease development in the epidemic form, decline of epidemic of plant diseases.
4. **Plant disease forecasting:** Concept, basis of plant disease forecasting, basic consideration of plant disease forecasting, critical weather and preparation of critical model for major plant disease forecasting: Late blight of potato, BLB of rice, Leaf blight of wheat, Grey blight of mustard etc.
5. **Methods of plant disease control:** Cultural, Legislative, Chemicals, Host resistance, Biological, Integrated approach-concepts, components and economics.
6. **Diseases of the following crops and their managemtn practices:**
   a. **Cereals:** Rice, wheat, maize, barley and millets.
   b. **Fibres:** Jute and cotton.
   c. **Pulses:** Pea, gram, lentil, blackgram, mungbean, grasspea and pigeonpea.
   d. **Oilseeds:** Mustard, groundnut, sesame, soybean and sunflower.
   e. **Sugar Crop:** Sugarcane.

Books Recommended:

1. Agrios, G. N. 1969. Plant Pathology. Academic Press, New York,
2. Alexopoulos, C. J. and E. S. Beneke. 1962. Laboratory Manual for Introductory Mycology, Bargees Publishing Co.
3. Ashrafuzzaman, M. H. 1976. 1st ed. Laboratory Manual of Plant Pathology. Department of Plant Pathology, BAU,
4. Ashrafuzzaman, M. H. 1976. A Lecture Guide to Crop Diseases. 1st ed. Department of Plant Pathology. BAU.
5. Barnett, R. 1. 1960. Illustrated Genera of Imperfect Fungi. Burgess Publishing Co.
6. Carter, W. 1962. Insects in Relation to Plant Diseases. McGraw Hill Book Company.
7. Frobisher, M. 1953. Fundamentals of Microbiology. Fifth edition, London, Saunders.
8. Funder, S. 1968. Practical Mycology. Hafner Publishing Co.

9. Leech, J. G 1940. InsectsTransmission of Plant Diseases. McGraw I Hill Book. Co.
10. Mehrotra, R. S. 1980. Plant Pathology. Tata McGraw Hill Publishing Co.
11. Rangaswami, G. 1962. Bacterial Plant Diseases in India. Bombay. Asia Publishing House.
12. Rangaswami, G. 1972. Diseases of Crop Plants in India. Prentice Hall of India Private Ltd.
13. S. H. OU. 1972. Rice Diseases. C. M. 1. Kew Surrey, England.
14. Schaad. N. W. 1980. Laboratory Guide for Identification of Plant Pathogenic Bacteria, Bacteriological Committee of America, Phytopatho logical Society. St. Paul. Minnesota.
15. Singh, R S. 1973. Plant Diseases. 3rd ed. Oxford. & IBH Publishing Co,
16. Singh, R. S. 1978. Introduction to Principles of Plant Pathology. 2nd edition. Oxford & IBH Publishing Co. Delhi.
17. Van der Plank, J. E. 1963. Plant diseases. Epidemics & control. Academic Press, New York. London.
18. Van der Plank, J. E. 1968. Diseases Resistance in plants, Academic Press, New York. London.
19. Wheeler, B. E. J. 1969. An Introduction to Plant Diseases, John Wiley and Sons Ltd.

CST. 307: GENETICS AND PLANT BREEDING–II

1. **Multiple alleles:** Concept and characteristics of multiple alleles, test of allelism; inheritance of multiple alleles.
2. **Quantitative inheritance:** Multiple factor hypothesis; Comparison of multiple factor inheritance with Mendelian inheritance.
3. **Sex determination and sex related inheritance:** Mechanism of sex determination; Sexlinked genes in plants and animals, Sex - limited and sex influenced traits.
4. **Extra-nuclear inheritance:** Features and types of' extranuclear inheritance; maternal inheritance and its significance.
5. **Heterosis and inbreeding:** Concept, types and measurement of heterosis, hypothesis of heterosis, inbreeding, effect of inbreeding and degree of inbreeding depression in self and cross pollination crops, techniques of hybrid seed production, heterosis vs inbreeding depression.
6. **Mutation breeding:** Types of mutagen, effect of mutagens spontaneous vs induced mutation, comparative effectiveness of physical and chemical mutagens, procedure of mutation breeding.
7. **Mode of pollination:** Characteristics of self and cross-pollinated crops, mechanism promoting self and cross pollination, determination of the mode of pollination. Conditon of effective pollination.
8. **Hardy Weingberg Law:** Law and its conditions.
9. **Mating System:** Random mating, genetic assortive mating, phenotypic assorting mating, genetic disassortive mating, phenotypic disassortive mating.
10. **Hybridization:** Concept, types and steps of hybridization, advantages and disadvantages.
11. **Distant hybridization:** Concept, objectives, barriers and application in crop improvement.
12. **Tissue culture:** Concepts and basic techniques in tissue culture, totipotency, prerequisites for cell and tissue culture, factors of plant regeneration, media preparation and sterilization techniques, achievement.
13. **Anther culture:** Procedure, factors influencing anthers in culture, utilization in plant breeding.
14. **Embryo culture:** Types, techniques, factors affecting the success of embryo culture and application in plant breeding.

15. **Somaclonal and gametoclonal variation:** Concepts, causes of somaclonal variation, application in crop improvement and selection of somaclonal variation
16. **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.

Books Recommended:

1. Application of Plant in *vitro* technology. 1993. Malaysian Biochemical society.
2. Brown, T. A. 2002. Gene cloning and DNA analysis: An introduction 4th edition. Blackwell science
3. Dixon, R. A. 1987. Plant cell culture: a practical approach IRL Press. Oxford, Washington DC.
4. Gamborg, 0. L. and Phillips. G. C. 1995. Plant cell. tissue and organ culture, Fundamental methods. Narosa Pub. House. New Delhi, Bombay. Loud. Madras, Calcutta.
5. Ignacimuthee. S.S. J. 1998. Plant Biotechnology IBH. Pub. Co. Pvt. Oxford.
6. Jane, K.; Setlow and Alexander. H. 1982. Genetics engineering. Principles and methods. Plenum Press, New York.
7. Michael. W. F., Graham. S. W. And young. M. M. 1992. Plant Biotechnology Perogamon Press, Tokyo, Seoul, Newyork, Oxford.
8. Moss. J. P. 1992. Biotechnology and crop improvement in Asia. Andraprodesh ICRISAT, India.
9. Old, R. W. and Primrose. S. B. 1994. Principles of Gene Manipulation- An introduction to Genetic Engineering. Blackwell Scientific Publications. London. 5 h edition,
10. Primrose, S. B. 1987. Modern Biotechnology. Blackwell Scientific Publications, London.
11. Proceeding of the International Symposium, 1993. Applications of plant in *vitro* technology. Malaysia, 16-18 Nov. 1993.
12. Raymond, L. ; Rodriguoz and Robert, C. Tait. 1983. Recombinant DNA techniques - An introduction. The Benjamin/ cummings Publishing Co. London.
13. Razdan, M. K. 2000. An introduction to Plant tissue culture oxford and IBH Pub. Co. Pvt. Ltd. New Delhi,
14. Robert, J. 1987. Tissue culture of selected tropical fruit plants; a hand book on the application of tissue culture of Plant propagation. FAQ, Rome.

CST. 308: AGRICULTURAL EXTENSION–II

A. Agricultural communication

1. **Meaning and concept of communication:** Origin, concept, nature and purpose of communication; types of communication; and importance of communication in extension work.
2. **Communication process:** Steps in communication process, elements of communication process, Models of communication- Laswell Model; Bradock Model; Shannon and Weaver Model; Defleur Model; Berlo Model; Oakley and Garforth Model. Noise and feedback in communication, Barriers of communication, ways of overcoming the barriers to communication, concept of communication fidelity.
3. **Communication Network and Levels:** Communication: Chain or Y, Wheel, Circle, Star, and Com-con. Pattern or form of communication.

B. Extension teaching methods

1. **Extension teaching:** Definition of teaching method and extension teaching methods, principles of teaching, criteria for effective extension teaching, steps of extension teaching methods, teaching plan, qualities of an effective extansion teacher, guideline for a sound teacher, different types of teaching methods. Factors influencing the choice of methods,
2. **Teaching method:** Purpose and classification of teaching aids, selection of appropriate teaching aids.

3. **Extension teaching methods with special reference to result and method demonstration:** Demonstration and its objectives, result demonstration and method demonstration, essential elements, advantages and limitation of result and method demonstration, comparison between result and method demonstration.
4. **Group discussion technologies:** Conference, seminar, symposium, workshop.

C. Diffusion of innovation

1. **Diffusion process:** Concept of innovation, adoption, diffusion and diffusion process, elements of diffusion process, characteristics of innovation, consequences of innovation.
2. **Innovation-decision process:** Stages of innovation-decision process, types of innovation-decision, barriers of diffusion innovation, factors affecting the diffusion among the farmers.
3. **Adopter categories of farmers:** Adopter categories of the farmers and characteristics of adopter categories.

Books Recommended:

1. Berlo, D.K. 1960. The Process of Communication. New York: Holt, Rinehart and Winston Inc.
2. Kv‡kg, Gg.G. 1992, m¤cÖmviY weÁvb, w` evsjv‡`k c¨vwKs †cÖm, XvKv|
3. McQuail, D. and Windahl, S 1981. Communication Models for the Study of Mass Communication. London: Longman.
4. Sandhu, A.S. 1993. Textbook on Agricultural Communication: Process and Methods.Kolkata: Oxford & IBH Publishing Co. Pvt. Ltd.
5. Singh, R, 1987. A Text of Extension Education. Sahityakala Prakashan, Ludhiana, India.
6. Supe, S. V. 1983. An Introduction to Extension Education. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.
7. Swanson, B.E. R.P. Bentz and A.J. Sofranko (1997). Improving Agricultural Extension: A Reference Manual. Rome: FAO of the United Nations.
8. Beal, G. M., Bholem, J.M. and Raudabaugh, J. N. 1962. Leadershipo and Dynamic Group Action. Iowa State University Press.
9. Bernard, H. W. 1975. Psychology of Learning and Teaching. McMillan Hill Books Co. N.Y.
10. Kreitlow, B. W., Aiton, E. W. and Lorrenes A. I. 1966. Leadership of Action in Rural Communities. Dauville, Illinois. The Interstate Printers and Pub. Inc.
11. Morgan, B.G., E. Holmes and C. L. Bundy. 1963. Methods in Adult Education. Ulinois. The Interstate Printers and Pub. Inc.
12. Supe, S.V. 1983. An Introduction to Extension Education. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.
13. Singh, R, 1987. A Text of Extension Education. Sahityakala Prakashan, Ludhiana, India.
14. †eMg, Gb.Gm. 1992, mvgvwRK M‡elYv cwiwPwZ, XvKv eyK nvDm|
15. Blackburn, D.J. (ed.). 1994. Extension Handbook: Processes and Practice. Toronto Thomprson. Educational Pub. Inc.
16. Khaleque, A., N.R. Sarkar and A. Rahman. 1988. Samajik Bigganey Gabesona Paddhati. Bangla Academy, Dhaka.
17. Kothari, O.R. 1990. Research Methodology; Methods and Techniques. Wiley Eastern Ltd. New Delhi.
18. Raj, H. 1987. Theory and Practice of Social Research. Surjee Pub. New Delhi.
19. iDd, †K.G. Ges Gjvnx, Gg. 1992, mvgvwRK M‡elYv c×wZ: ZË¡ Ges cÖ‡qvM, myR‡bly cÖKvkbv, XvKv|

CST. 309: AGRICULTURAL CHEMISTRY–II

Pesticide, Nuclear and Agro Industiral Chemistry

1. Pesticide chemistry

Classification of pesticide, preparation/manufacture, properties, mode of action and safety measures of commonly used pesticides:

Natural organic compounds: Pyrethrin, Nicotine, Rotenon.

Orgonochlorinated hydrocarbons: DDT, Dieldrin, Heptachlor.

Orgonophosphorus compounds: Nogos, Bidrin, Diazinon, Dimecron, Malathion, Methyl Parathion.

Organocarbamate: Sevin, Furadan.

Synthetic fungicide: Captan, Folpet, Dithane M-45, Dithane Z-78, Rovral.

Herbicide: Dalapon, Ronstar, 2, 4-D.

2. Instrumental methods of analysis

Working principles of a pH meter, colorimetry, spectrophotomentry, fluorimetry, infrared and ultraviolet spectrophotomentry, flame emission and atomic absorption spectrophotomentry and chromatography.

3. Colloids and plant nutrition

Definition, classification and properties of colloids, role of clay colloids in plant nutrition, ion transport, ion uptake (CO_2 theory and contact exchange theory), adsorption isotherms, relationships of nutrient ions, nutrient status of soils and plants, available forms of different nutrients.

4. Nuclear chemistry

Nuclear stability, radio-isotopes, interactions of radiations with matter, half-life, radiation detection, radiation safety, application of radio-isotopes in agricultural research, selection of isotopes for tracer studies, sample preparation for isotopic study.

5. Chemistry and technology of agroindustrial products

Sugar: Condition and quality of sugarcane, manufacture of white sugar: extraction of juice, clarification of the juice, evaporation of the clarified juice to make syrup, industrial utilization of sugar mill byproducts.

Tea: Processing and fermentation of tea leaves.

Natural rubber: Physiology of latex flow and its coagulation, tapping system, chemical and physical properties of synthetic rubber, Vulcanization and Compounding of natural and synthetic rubber.

6. Bioremediation: Concept, scope and importance forms of remediation, prospects of bioremediation in Bangladesh. Mechanisms of micronutrient uptake and translocation in plants. Function and interactions of micronutrients in plant and soils. Fertilizer applications for correcting micronutrient deficiencies. Environmental and soil factors affecting micronutrient deficiencies and toxicities.

7. Environmental Chemistry: Concepts and components of environment, sources of toxic substances, their routes and metabolism and biochemical effect. Effect of pesticides and fertilizers on soil, plant, water, fish and their influence on the environment. Compatibility of pesticides with agrochemicals, pesticides and health hazards. Chemical and photochemical reactions in the atmosphere, inorganic and organic pollutants with their effect on plants, bioaccumulation and biotransformation of chemicals in aquatic environment.

Books Recommended:

1. Das, R.K. 1987. Industrial Chemistry, Part-2, Kalyani Publishers, New Delhi.
2. Ramulu, U.S.S. 1985. Chemistry of Insecticides and Fungicides. Oxford and IBH Publishing Co, New Delhi, India.
3. Dhingra, K.C. 1984. Hand book of Rubber and Rubber goods Industries, Small Industry Research Institute, Delhi.
4. Hermias, S.M. and Joecile, S.M. 1984. Radioactivity: Fundamentals and Experiments, Holt, Rinehart and Winston, Inc. USA.
5. R.R.I.M. 1980, Tapping and Tapping System & yield stimulation of Hevea. Malaysia.
6. Annual short Course, 1989. Brief notes on Tea culture, B.T.R.I. Srimongal, Moulvibazar.
7. Mathur, R.B.L 1987. Hand Book of Cane Sugar Technology. Oxford and IBH Publishing Co. India.
8. Clesceri, L.S.; Greenberg, A.E and Trussel, R.R (Edi.) 1989. Standard Methods for the Examination of Water and Waste. 17th Edn. APHA. Washington, D.C. USA
9. Page, A.L.; Miller, R.H. and Keeny, D.R. (Edi) 1982. Methods of Soil Analysis. Part. 2, American Society of Agronomy, American Society of Soil Science, Inc. Madison, Wisconin, USA.
10. Willard, H.H.; Merritt Jr. L.L and Dean, J.A. 197. Instrumental Methods of Analysis, Litton Education Publishing Inc. New York, USA.
11. Jeffery, G.H.; Bassett, J.; Mendham, J. and Denney, R.C. 1989. Vogel's Text book of quantitative chemical analysis. Longman Scientific and Technical, Longman Group U.K. Ltd. Essex CM20 2JE, England.
12. Kanwar, J.S 1978. Soil Fertility-Theory and Practice. Indian Council of Agricultural Research (ICAR), New Delhi.
13. Bohn, H.L.; McNeal B.L. and O' Connor, G.A. 1979. Soil Chemistry. John Wiley and Sons, New York.
14. Hesse. P.R. 1994. A Text book of Soil Chemical Analysis, CBS Publishers and Distributors, Delhi, India.
15. Ramulu, U.S.S. 1982. Isotopes in Agriculture, Oxford and IBH Publishing Co., New Delhi.
16. Chopra, S.L. and Kanwar J.S. 1986. Analytical Agricultural Chemistry. Kalyani Publishers, New Delhi.

CST. 310: AGRICULTURAL STATISTICS–II

Research Methodology

1. **Regrassion:** Multiple regression, fitted line of multiple regression, test of significance.
2. **Methodology:** Meaning of methodology, methods of data collection and sampling, estimation of sample sizes, methods of construction of indices, study of methodologies of different notation and local survey.
3. **Sample survey:** Ideas of field survey, sample survey and complete enumeration, steps in a sample survey, preparation of questionnaire, schedules, instruction etc, survey enumeration, pilot survey, requirement of good sample design. Sampling and non-sampling errors, accuracy and precision.
4. **Random sampling:** Procedure of selecting a random sample, Study of simple random sampling, Stratified random sampling, Systematic sampling, Cluster sampling.
5. **Test of Significance:** Hypothesis, null hypothesis, alternative hypothesis, type-I error, type-II error, level of significance. Preliminary concept of t-test, F-test, chi-square, test and their applications: testing of hypothesis regarding population mean, equality of two means, population variance, goodness of fit and independence of two attributes in a contingency table, test of significance of correlation coefficient and regression coefficients.
6. **Experimental design:** Basic concepts and principles of Experimental design. Completely randomized design, randomized block design and latin square design including multiple

comparison test (LSD and DMRT). Missing plot technique. Introduction to factorial experiments and split-plot design.

Books Recommended:

1. Ahmed A. Rashid, M. A. A. Bhuiya and M. Z. Hossain: Experimental Designs Theory and Application.
2. Cochran & Cox. 2000. Experimental Design, 2nd Ed, Wiley, New York.
3. Das, M.N. and N.C. Giri 1986. Design and Analysis of Experiments, 2nd Ed, Wiley Eastern Ltd., India.
4. Montgomery, D. C. 2003. Design and Analysis of Experiments. 5nd Ed, Wiley, New York (Principal Text).
5. †eMg, Gb.Gm. 1992, mvgvwRK M‡elYv cwiwPwZ, XvKv eyK nvDm|
6. Blackburn, D.J.(ed) 1994. Extension Handbook: Processes and Practice. Toronto Thomprson. Educational Pub. Inc.
7. Lv‡jK, G., Gb.Avi. miKvi Ges G. ingvb, 1988, mvgvwRK weÁv‡b M‡elYv c×wZ, evsjv GKv‡Wgx, XvKv|
8. Kothari, O.R. 1990. Research Methodology; Methods and techniques. Wiley Eastern Lid. New Delhi.
9. Raj, H. 1987. Theory and Practice of Social Research. Surjee Pub. New Delhi.
10. iDd, †K.G. Ges Gjvnx, Gg. 1992, mvgvwRK M‡elYv c×wZ: ZË¡ Ges cÖ‡qvM, myR‡bly cÖKvkbv, XvKv|
11. Barnett, V. 1979. Sample surveys: Principles and Methods, Edward Arnold, London.
12. Chudhuri, A. and H. Stenger 1992. Survey sampling Methods and Thorey.
13. Cochran, W.G. 2002. Sampling Technique, 4th ed, Wiley, N.Y.
14. Kish. 1995. Survey Sampling, Wiley, N.Y.
15. Mukhopadhayay 2000. Theory and Methods of Survey Sampling, Prentice-Hall of India (P.) Limited, New Delhi.
16. Murthy, M.N. 1977. Sampling Methods, 2nd ed.
17. Som, R.K. 1973. Practical Sampling Technique, Marcell Dekkar.

PRACTICAL COURSES

B.Sc.Ag. (Hons) Part-III

CST. 311: AGRONOMY–III

1. Preparation of nursery beds (wet and dry) for raising seedlings of rice and tobacco.
2. Practising different methods of planting sugarcane.
3. Irrigation scheduling for a crop.
4. Raising a green manure crop and its incorporation in the soil.
5. Computation of production cost of crops rice, wheat, tobacco, sugercan and jute.
6. Preparation of crop rotation schedules for field crops.
7. Study of major cropping pattern of Bangladesh in relation to climatic parameters.
8. Preparation of crop calendar.
9. Raising a crop and studying its different growth phases and stages.
10. Growing intercrops and evaluation of their performance.
11. Study on the nodulation in different legumes, pulses, ground nut, sunhenp, dhaincha from pot culture.

CST. 312: SOIL SCIENCE–II & III

1. Determination of soil pH by glass electrode pH meter.
2. Determination of organic carbon in soil by the wet oxidation method and estimation of organic matter.
3. Determination of lime requirement of soil.
4. Determination of free carbonates of soil by HCL titration method.
5. Determination of CEC by Ammonium acetate extraction method.
6. Determination of Electrical Conductivity of soil by EC meter.
7. Principle and uses of compound microscope.
8. Techniques of sterilization.
9. Preparation of Bacterial media.
10. Gram staining of Bacteria.
11. Isolation and authentication of *Rhizobium* from legume root nodule.
12. Preparation, production and application of *Rhzobium* bio-fertilizer.
13. Preparation, production and application of Azolla.
14. Preparation, production and application of BGA.
15. Preparation, production and application of normal Compost and Vermicompost.
16. Total count of bacteria and Blue-Green Algal inoculants.

CST. 313: HORTICULTURE – III

1. Field visit for identification of horticultural crops (vegetables and spices) in different areas of Bangladesh and preparation of album.
2. Practicing of intercultural operation in different vegetable crops.
3. Diffierent planting methods of vegetables with sowing dibbling and transplanting.
4. Estimation of seed rate and fertilizer doses for different vegetable crops.
5. Methods of manuring and fertilizers of vegetable crops.
6. Field layout for planting vegetable crops.
7. Cultivation of vegetables in individual plot.
8. Identification of seeds and seedlings of vegetables and spices.
9. Study of important morphological features related to production of some important vegetable crops, spices and condiments.
10. Estimation of cost of cultivation of tomato, potato, cabbage and brinjal.
11. Seedling evaluation test of important vegetables using CDT.
12. Seed extraction technique and processing of tomato, brinjal and white gourd.
13. Propagation practices of vegetable crops.

CST. 314: CROP BOTANY–III

1. Experiments to demonstrate- osmosis, plasmolysis, transpiration and ascent of sap.
2. Measurement of water status and water potential in plant tissues.
3. Study of distribution and abundance of stomata in different types of leaves.
4. Study of anatomical structure of leaves in C_3, C_4 and CAM plants.
5. Experiments to demonstrate photosynthesis and respiration.
6. Experiments on plant pigments: separation, quantification and chlorophyll stability index.
7. Estimation of dry matter (DM) production, determination of moisture content, leaf area (LA), leaf area index (LAI), light interception measurement.
8. Techniques of crop growth and yield analysis.
9. Demonstration of the effects of different PGRs (Plant Growth Hormones) on growth and yield in crops.

CST. 315: ENTOMOLOGY–II

Systematic Entomology

1. Method of collecting, preparing and preserving insects (immature and adult stages) and mites.
2. Collection and identification of insects (upto 75 families) of economic importance in Bangladesh and setting in insect Boxes.

Plant protection Equipment's

1. Pest controls appliances (ground and aerial), their operation and maintenance.

CST. 316: PLANT PATHOLOGY–II

Field & Laboratory studies of plant diseases.

a) Detailed study (symptoms, preparation of slides and identification of pathogens) of the followings:
   i. Brown spot, Blast & BLB of Rice.
   ii. Stem rot, Black band & Anthracnose of Jute.
   iii. Leaf blight, leaf rust, foot rot & loose smut of wheat and covered smut of barley.
   iv. Tikka, leaf rust & collar rot of groundnut.
   v. Root-knot diseases.
   vi. Cercospora leaf spot of blackgram & mungbean.
   vii. Alternaria blight of crucifers.
b) Brief study (symptoms aided by permanent slides of the pathogen) of the followings:
   i. BLB,BLS, Stem rot, Bakanae, False smut, NBS, Sheath blight, Sheath rot, Leaf scald, Ufra, Grassy stunt, yellow dwarf and Tungro of rice.
   ii. Leaf spot, Soft rot & Mosaic of Jute
   iii. Angular leaf spot & Ball rot of cotton
   iv. Foot and root rot, mosaic, rust, wilts & blights of pulses and oilseed crops.
   v. Smut, Wilt, White leaf, Pineapple disease and Red rot of Sugarcane.
c) Demonstration of Koch's postulates by using fungi, bacteria, nematodes and viruses.
d) Studies on the diseases in seedbed.

CST. 317: GENETICS AND PLANT BREEDING– II

1. Prerequisites for an ideal tissue culture laboratory
2. Media preparation
3. Preparation of explants
4. Sterilization of media and explants.
5. Problems on Chi-square test: Collecting F2 data from GPB experimental farm to perform Chi-square test for goodness of fit to Mendelian and Non Mendelian ratios.
6. Estimation of heterosis.
7. Problems on quantitative inheritance: Collection of data from genetic populations such as P_1, P_2, F_1 and F_2 to study quantitative inheritance.
8. Hybridization techniques in crop plants.
9. Problems on gene interaction.
10. Data analysis for variety testing.

CST. 318: AGRICULTURAL EXTENSION–II

1. Demonstration: conducting method and result demonstration.
2. Teaching aid: preparation and use of poster, flash cards, leaflet, circular letter, flash cards and computer aided slide.

3. Preparation and presentation of farm radio talk.
4. Use and handling of different aids in extension teachings: OHP, Slide projector, Multimedia,
5. Preparation and use of different charts and graphs for presentation of data.
6. Survey and collection data of regarding agricultural activities.
7. Compilation, tabulation and analysis of data.
8. Preparation and presentation of survey report.
9. Tools for diffusion of innovation: Radio & TV programme, Field day, Farmers rally and Agricultural fair.
10. Extension field trip: field trip to near by Upzila for a week and submission of its report

CST. 319: AGRICULTURAL CHEMISTRY–II

1. Preparation of plant extract by dry and wet oxidation (di-and tri acid mixture) method. Estimation of N, P, K, Ca, Mg, S and Na from plant extract, fertilizer and water samples.
2. Manures and fertilizer analysis: Moisture and nutrient contents in cow dung, FYM, poultry manure, green manure, compost, urea, SSP, TSP, DAP, MP, gypsum, zinc sulphate and borax.
3. Water analysis: Surface, ground and rain waters for dissolved constituents and nutrients.
4. Techniques of pesticide formulation and residue analysis.
5. Preparation and coagulation of colloids
6. Radio tracer techniques.
7. Generation of bio-energy from wastes.
8. Collection and preparation of various wastes.
9. Analysis of domestic, municipal and industrial wastes.
10. Determination of available and total micronutrients in soil.
11. Fractionation of micronutrients in soils and assessment of the fate of applied micronutrients in soil.
12. Interpretation of soil analysis data with crop yield and micronutrient concentration and plant uptake.
13. Agro-Industrial Tour and Report preparation.

CST. 320: AGRICULTURAL STATISTICS–I & II

1. Construction of frequency distribution table and graphical representation of data, calculation of various measures of central tendency and dispersion.
2. Fitting simple linear regression and correlation co-efficient to observe data.
3. Testing hypothesis regarding population mean and variance. Testing significance of simple correlation coefficient and regression coefficients. Use of chi-square for testing goodness of fit and test of independence of two attributes in a contingency table.
4. Layout plan and analysis of variance for Completely Randomized Design, Randomized Block Design, Latin Square Design including multiple comparison test (lsd and DMRT).

CST. 321: INTERNSHIP: AGRICULTURAL PRACTICAL EXPERIENCE (APE)

Work Schedule

Each student shall spend 3 months (one crop season) in the 3rd year and shall be attached to a particular farm from any one of the following areas:

Zhum cultivation: Sylhet/Rangamati.

Offshore areas of Khulna, Barisal, Patuakhali, Bhola and Noakhali.

Barind Tract: North of Naogaon, Part of Dinajpur, Nawabgonj and Rajshahi.

Rajshahi district and adjacent area.

Sstudents shall be sent to a particular area in batches accompanied by competent person(s) to be decided by the department. For this course total cost will be estimated by the Dean of the faculty in consultation with the Chairman of Departments. Certain amount of this cost should be borne by the student which shall be submitted as fees at the time of form fill up in the 3rd year.

Each student shall follow the specific work schedule as given below in respect of the above areas.

THEORY COURSES

B.Sc.Ag. (Hons) Part-IV

CST. 401: AGRONOMY–IV

1. **Production technology of crops:** Origin, classification climate and soil requirements, characteristics of species, subspecies and cultivars, cultivation practices, post-harvest operations and cost of production of the following crops.

a. **Fibre crops:** Jute, cotton, summhemp and kenaf

b. **Oil crops:** Mustard, sesame, groundnut, soybean, linseed, sunflower, safflower and castor.

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

d. **Quality control of crops:** Factors affecting the quality of crops. Agronomic means of improving quality of crops.

2. **Land use and crop statistics in Bangladesh:** Categories of land use system, area, production, and yield of crops of Bangladesh over time.

3. **Agricultural labour:** Definition, classification, factors governing supply of labour, problem of labour and improvement of labour efficiency.

4. **Farming:** Definition, types of farming with advantages and disadvantages

5. **Farm planning, budgeting and management:** Factors to be considered for the establishment of a farm. Farm layout and farm budgeting. Farm records: concept, objectives, types and their maintenance. Economic principles of applied to farm management. Principles of selection of farm enterprises.

6. **Cropping scheme:** Utility and principles of preparation.

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

8. **Crop evaluation:** Crop yield estimation, crop cutting experiment, crop reporting, and crop forecasting.

Books Recommended:

1. Beneke, R.R. 1966. Managing the Farm Business. John Wiley and Sons, Inc. New York, London, Sydney.
2. 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.
3. Efferson, J.M. 1953. Principles of Farm Management. McGraw- Hill Book Co., New York.
4. Hedge, T.R. 1969. Farm Management Decision. Prentice Hall, Inc. Englewood Cliffs. London.
5. Hoques, M.Z. 1984. Cropping Systems in Asia. On-Farm Research and Management. IRRI, Philippines.
6. Kipps, M.S. 1978. Production of Field Crops. 6th Edition. Tata McGraw-Hill Pub. Company Ltd. New Delhi, India, 790p.
7. Kundu. D.; Basak, K.C. and Sarker, P.D. 1959. Jute in India. Indian Central Jute Committee, Calcutta, India.

8. Martin, J.H., Leonard, W,H. and Stamp, D.L. 1967. Principles of Field Crop Production. 3rd Edn., McMillan New York. 1118p.
9. Quddus, M.A. 1985. Bangladesher Khadya Shasya O Arthakari Phasaal. Bangla Academy, Dhaka. 403p.
10. Thakur, C. 1979. Scientific Crop Production. Vol. I and II.3rd Edn. Metropolitan Book Co., New Dehli-1 10002, India.
11. Holmes, W. 1987. Grass- its production and utilization. The British Grassland Society, Blackwell Sc. Pub.. London.
12. Langer. R.H.M. 1973. Pasture and Pasture Plants. A.H. and A. W. Reed *Ltd. Wellington*. Sydney. London.
13. Pearson. C.J. and lson, R.L. 1987. Agronomy of Grassland Systems. Cambridge University Press, New York, Sydney.
14. Van Der Meer, H.G.: Fyden, J.C. and Ennik. G.C. 1986. Nitrogen Fluxes in intensive grassland systems. Martinus Nijhoff Publishers. The Netherlands.
15. White, J.G.H. 1989. Herbage Seed Production. Wellington, New Zealand.
16. Whitehead, D.C. 1970. The role of nitrogen in grassland productivity. Commonwealth Agricultural Bureau. England.

CST. 402: SOIL SCIENCE–IV

Soil Fertility and Fertilizer Management

1. **Introduction to Soil fertility and Plant nutrition:** Definition and distinction between soil fertility and productivity. Essential plant nutrient elements-criteria, sources and available forms, macro and micro elements, Role of N, P, K, S, Ca, Mg, Fe, Cu, Mn, Zn, B and Mo for plant growth and development (major functions and deficiency symptoms). Depletion and conservation of soil fertility in Bangladesh.

2. **Organic manures and fertilizers:** Concept, kinds and composition of important organic manures; concept, types and significance of bio-fertilizers; distinction between organic matter and humus; OM decomposition–actions, enzymes involves, factors influence, C/N ratio and significance of C/N ratio, humus formation process- modern theory; Role of OM on soil fertility. Manures and chemical fertilizers–commonly used fertilizers, concept of integrated fertilizer management.

3. **Nitrogen:** N in soil and plants, N-cycle, forms of N; Mineralization and immobilization process, Nitrification, Denitrification, NH_3–volatilization, and chemo-denitrification, N-fertilizers and fertilization.

4. **Phosphorous:** Occurrence of P in soil, forms of soil P, P-fixation, factors affecting P-Fixation, P-Fertilizers and fertilization, P-cycle.

5. **Sulphur:** Occurrence and sources of S, S oxidation and reduction, factors affecting S availability in soils, S-fertilizers and fertilization, S-cycle.

6. **Calcium and Magnesium:** Sources and behaviour, forms utilized by plants, Losses, fertilizers and fertilization.

7. **Iron and Zinc:** Iron-occurrence and forms of soil Fe, factors affecting Fe availability, Fe-fertilizers and fertilization. Zinc–occurrence and forms of soil Zn, factors affecting Zn availability, Zn-fertilizer and fertilization.

8. **Boron and Molybdenum:** Occurrence and forms of soil B, B in plants, factors affecting B availability, relative sensitivity of selected corps to B deficiency, B-fertilizers and fertilization. Molybdenum: Occurrence in soils, soil solution of Mo, factors affecting Mo availability, Mo toxicities, Mo Sensitive corps, Mo fertilizers and fertilization.

9. **Nutrient uptake theories:** Brief account of important nutrient uptake theories

10. **Soil fertility evaluation:** Concept of soil fertility evaluation, soil analytical data and their interpretation for the recommendation of fertilizers.

Books Recommended:

1. Alexander, M., 1977. Introduction to Soil Microbiology. John Willy and Sons, New York.
2. Brady, N.C. 1990. The Nature and Properties of Soil. McMillan Pub. Co. New York.
3. Jackson, M.L. 1965. Soil Chemical Analysis. Prentice Hall. Inc. New York.
4. Tisdale, S.L., Nelson, W.L. and Beaton, J.D. 1990. Soil Fertility and Management. McMillan Pub.Co. New York.
5. Meugel, K. and E.A. Kirkov. 1987. Principles of Plant Nutrition. Inst. Potash Inst. Pub. Switzerland.
6. Miller, R.W. and R.L. Donhue. 1992. Soils–An Introduction to Soils and Plant Growth. Prentice - Hall Pvt. Ltd., New Delhi.
7. Stevenson, F.J. 1986. Cycles of Soil–Carbon, Nitrogen, Phosphorus, Sulphar and Micronutrients. John Wiley and Sons. New York.
8. Thompson, L.M. and F.R. Troch. 1978. Soils and Soil Fertility. McGraw Hill Inc. New York.
9. N.K. Fageria, V.C. Baligar, C.A. Jones. 1991. Growth and Mineral Nutrition of Field Crops. Marcel Dekker Inc., New York.
10. Donahue, R.L., R.W. Miller & J.C. Shickluna. 1983. Soil An Introduction to Soil and Plant Growth. Prentice-Hall Inc. New Jersey.
11. Tisdale, S., W.L. Nelson, J.D. Beaton and J.L. Havlin. 1997. Soil Fertility and Fertilizer. Prentice-Hall of India Private Ltd.
12. Fertilizer Recommendation Guide-1997. Bangladesh Agricultural Research Council.
13. S.S. Singh. 2000. Soil fertility and Nutrient Management. Kalyani Publishers.
14. Das, P.C. 1999. Manures and Fertilizers. Kalyani Publishers.
15. Das, D.K. 1999. Introductory soil science. Kalyani Publishers.
16. Sahai, V.N. 2001. Fundamentals of Soil. Kalyani Publishers.

CST. 403: HORTICULTURE – IV

Pomology and Plantation Crops

1. **Introduction to pomology:** Definition, nomenclature and classification of fruits on the basis of their edible portion.
2. **Geograhical distribution of fruits:** Major fruit growing regions of the world, their climatic features and distribution of fruit plants.
3. **General aspects of fruit production in Bangladesh:** Scope, importance, area, production and regional distribution of the common fruits. Factors affecting the production and distribution of the major fruit plants. Application of plant growth regulators in improving production and quality of fruits.
4. **Propagation of fruit plants:** Methods of propagation, seedage, apomixes and polyembryony, cuttage, layerage, graftage & buddage; Stionic relationshiop and incompatibility in grafting, micropropagation, its principles and techniques.
5. **Fruit nursery management:** Definition, establishment and management of modern nursery, plant-propagating structures with short decription of greenhouse, lathhouse, nethouse, hotbed, cold frame and mist propagating unit, growing and propagating nursery plants; protection measures in them with related equipment.
6. **Establishment and management of fruit orchards and homestead gardens:** Site selection; land development and planting plans, fertilizing and manuring, controlling soil erosion in the orchard, irrigation and drainage, training & pruning, intercropping and other management practices,
7. **Fruit tree management practices:** Molecular mechanism of floral induction of fruit development and maturity; unfruitfulness of fruit trees; causes and remedies; use of growth regulators in fruit industry and methods of their application.

8. **Study of the following fruits:** Morphology, production, statistics, soil, climate, varieties, propagation, improvement management and harvesting; banana, pineapple, papaya, mango, jackfruit, litchi, guava, jujube, coconut, citrus fruits and some important minor and exotic fruits.
9. **Introduction to plantation crops:** Definition and nomenclature, importance, problems and scope of plantation crops in Bangladesh.
10. **Production, management and processing of plantation crops:** Tea, rubber, oil palm, coffee, cocoa, betel leaf, betel nut and bamboo.

Books Recommended

1. Bose T.K. and S.K. Mitra. 1995. Fruits: Tropical and Subtropical. Naya Prokash, 206, Pidhan Sarani, Calcutta-6, India.
2. 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.
3. gÛj, Gg.Gd. Ges Avi. Avwgb, 1990, d‡ji evMvb wg‡mm Avwdqv gÛj (m¤úv.), evGBD K¨v¤úvm, gqgbwmsn|
4. Samson, J.A. 1980. Tropical Fruits. Longman, London & New York.
5. Adriance and Brison, 1955. Propagation of Horticultural Plants. McGraw Hill Book Company, New York.
6. Berrie, A.M.M. 1977. An Introduction to the Botany of Major Crop Plants Moyden & Sons Ltd. London.
7. De, K.K. 1992. An Introduction to plant tissue culture, New Crntaral Book Agency, Calcutta.
8. Gardner, V.E., F.C. Bradford and M.D. Hooker 1952. Fundamentals of fruit Production, McGrraw Hill Book Company, New York.
9. Hartmann, H.T., D.E. Kester and F.T. Davies Jr. 1990 plant propagation principle and practices. Prentice-Hall, Iner, Editions.
10. Hayes, W.D. 1960 Fruit Growing in India, Kitabistan, Allahabad.
11. Kvgvj DÏxb, G.Gm.Gg. d‡ji Pvl, Kvgi"b bvnvi, AvwRgcyi, XvKv|
12. Stephen, H.H. 2003. Molecular Genetics of Plant Development. Cambridge Univ. Press.
13. Naik, K.C. 1963. South Indian fruits and their culture, P. Varadachary & Co., 8. Longhi Chetty Street, Madras.
14. Singh: R.B. 1961. Fruits. National Book Trust, New Delhi.
15. Mukhopadhyay, S. 1995. Commercialization of micropropagated Plants in India. New Deihi.
16. S. Prasad and U. Kumar.1999. Principles of Horticulture. Agrobotanica. 4E 176 Jn. Vyas Nagar, Bikaner, India.
17. Jules Janick.1982.Horticultural Science.Surjeet Publications, 7k, Koihapur, Kamla Nagor, Delhi.
18. J.B. Edmiond *et al*. Fundamentals of Horticulture. Tata McGraw-Hill Publishing Co. Ltd. New Delhi.
19. ivgvb› PµeZx©, 1999, D`¨vbweÁvb Ges dj I mwâ msMÖn, Z…Zxq ms¯‹iY, cwðg evsjv, fviZ|

CST. 404: ENTOMOLOGY–III

Insect Ecology, Economic Entomology and IPM

1. **Insect ecology:** Influence of environmental factors on the insect population in agro-ecosystem, growth forms of insect populations. Survillance, forecasting and warning Systems in insect pest management.
2. **Disease transmission:** Disease and vectors; types and mechanisms of transmission of insect borne diseases in plants
3. **Economic entomology and vertebrate pests:** Bioecology, nature of damage and control measures of major insect and mite pests of field crops (rice, jute, wheat, sugarcane, cotton, tobacco, mustard, soybean and groundnut) and forest plants. Bioecology, damage assessment and control of vertebrate pests laying emphasis on the rodents of field crops and in storage.
4. **Integrated Pest Management:** Definitions, Descriptions of different methods with their relative merits and demetits.
   a) **Management tactics**: Plant resistance; components of resistance, mechanism of resistance, development of insect resistant varieties.
   b) **Cultural control**: various types of mechanical control and their merits and demerits
   c) **Mechanical control**: various types of mechanical control and their merits and demerits
   d) **Physical control:** various types of mechanical control and their merits and demerits
   e) **Biological control**: Use of parasitoids and predators. Ecological back grounds.Advantages and disadvantages, procedures and techniques.
   f) **Behavioral control**: Semiochemicals-pheromones and allelochemicals. Constraints of semiochemicals employment.
   g) **Phytochemicals and natural dusts**: Botanical pesticides and nutural dusts (DE).
   h) **Chemical control**: Use of synthetic and pesticides in pest management, classification, formulation, mode of action etc.
5. **Industrial Entomology:** Concept of apiculture, sericulture and lac culture; their classification and implement in Bangladesh.

Books Recommended:

1. Chishester, C.O.1965.Research in pesticides, Academic press, New York.
2. Metcalf, R.L.1966-70.Advances in pest control research. Vols. 1, 2, 3, 4 and 5 Inter science publisher, New York and London.
3. Patton, H.R.1963.Introductory insect physiology saunder phila.
4. Wigglesworth, V.B. 967. The principles of Insect physiology. Mathuen and Co. London.
5. Dent, D.1991.Insect pest management. CAR International.
6. Alam, M.Z. 1965. Modern insecticides and their uses. Agril. Intform. Serv., Publ., Dhaka.
7. Evans, 1994.Advances in Insect physiology.Vol.25, Intercept Ltd. London.
8. O-Brien, R.D. 1967. Insecticides action and Management. Academic Press. New York.
9. Leach, J.G. Insect Transmission of Plant Diseases. McGraw Hill Book Co. Inc. New York.
10. Price, P.W. 1984. Insect Ecology (2nd Ed.), John Willy and Sons. New York.
11. Singh, H. 1982. Beekeeping in Indian Council of Agricultural Research, New Delhi.
12. Posamentier, H. adn A.V. Elsen. 1984. Rodent Pests- Their Biology and Control in Bangladesh. BARC Printers, Dhaka, Bangladesh.

CST. 405: PLANT PATHOLOGY–III

1. **Diseases of fruits:** Mango, banana, papaya, coconut, pineaple, jackfruit, citrus and guava.
2. **Diseases of vegetables:** Potato, tomato, sweet potato, cabbage, cauliflower, chilli, brinjal, lady's finger, amaranth, cucrubits and beans.

3. **Diseases of cash crops:** Tobacco, tea, betelnut, betelvine, turmeric, ginger, onion & garlic.
4. **Nursery diseases:** Diseases of agroforest trees. Root rots, dieback, wilts and cankers of important forest trees.
5. **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.
6. **Assessment of Crop loss owing to plant diseases:** Importance, methods of crop loss assessment, simulation of crop loss assessment through mathematical point model, critical point model and multiple point models.
7. **Biotechnology and Molecular biology in relation to Plant Pathology:** Concept, definition, plant pathological tissue culture, pathogenicity related genes, development of disease resistant crop through recombinant DNA technique, molecular biology of plant pathogens.

Books Recommended:

1. Anderson, H. N. 1979. Diseases of fruit crop. McGraw Hill Book Co.
2. Ashrafuzzaman, M. H. 1976. 1st ed. Laboratory Manual of Plant Pathology. Department of Plant Pathology.
3. Barnett. H. L. 1960.Illustrated Genera of Imperfect Fungi. Burgess Publishing Company.
4. Boyce. J. S. 1961. Forest Pathology 3rd ed. McGraw Hill Book Co.
5. Chester, K. S. 1941. Nature and Prevention of plant diseases. Blakiston.
6. Fergus. C, L. 1966. Illustrated Genera of Wood Decay Fungi. Burgess Publishing Company.
7. Fulton .J. P., D. A. Slack. N. D. Fulton, J I. Dale. M. J.I. Eoodeand and G, F. Templeton. 1965, Plant pathology Laboratory Manual. Burgess Publishing Company.
8. 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.
9. Meah, M. B. and A. A. Khan. Mango diseases. Dept. of Plant Pathology. Bangladesh Agricultural University,
10. Pathak, V. N. 1986. Diseases or Fruit Crops. Published by Mohan Primlani, Oxford & IBH Publishing Co., Janpath, New Delhi 110001.
11. Ranaswami, G. 1972. Diseases of Crop Plants in India. Prentice Hall of India Private Ltd.
12. Singh, R. S. 1973. Plant Diseases. 3rd ed. Oxford & IBH Publishing Co.
13. Singh, R. S. 1987. Diseases of Vegetable Crops. Oxford & IBH Publishing Co. Pvt., Ltd. New Delhi, Bombay.
14. Stakman. F. C. and J. G. Harrar, 1957. Principles of Plant Pathology. The Ronald Press Company.
15. Walker, J. C. 1952. Diseases of Vegetable Crops. McGraw Hill Book Co.
16. Walker, J. C. 1957. Plant Pathology, McGraw Hill Book Company.
17. Wheller B. E. J. 1969. An Introduction to Plant Diseases. John Wiley and Sons. Ltd.
18. A.B.A.M. Baudoin. 1990. Laboratory Excerses in Plant Pathology: An Instructional Kit. American Phytopathogical Society Scientific Publishers. Ratanada Road, P.O. Box 9l. Jodhpur-342001. India.
19. British Society for Plant Pathology by Blackwell Scientific Publication
20. C.J. Alexopoulos and E.S. Beneke. Laboratory Manual for Introductory Mycology. Bargees Publishing Co.
21. Common Wealth Mycological Society. Plant Pathologist Pocket Book 2nd Edition. CMI, Kew, Surrey, England
22. G. Rangaswami. Diseases of Crop Plants in India. Prentice Hall of India Private Limited.
23. 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.
24. 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)
25. I.H. Mian. Methods in Plant Pathology. IPSA - JICA Project 1995. Institute of Post Graduate Studies in Agriculture, Gazipur, Bangladesh.

26. J.M. Walker, B.J. Ritchie and M. Holderness. Plant Clinic Handbook. IMI Technical Hand Books no.3, An Institute of CAB International.
27. M.H.Ashrafuzzaman. Laboratory Manual for Plant Pathology. Department of PaInt Pathololgy, BAU, Mymensingh -2202,
28. N,W.Shcaad, Laboratory Guide for Identification of Plant Pathogenic Bacteria. Bacteriological Committee of American Phytopathological Society, St. Paul, Minnesota.
29. R.A. Lelliott and D.E. Stead. Methods for the Diagnosis of Bacterial Diseases of Plants.
30. R.S. Mehrotra. Plant Pathology. Tata McGraw-Hill fill Publishing Company Limited, New Delhi, India.
31. R.S. Singh. Plant Diseases 3rd d Edition. Oxford & IBH publishing Co. New Delhi.
32. 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 0-89054047-0), Citrus Diseases (ISBN 0-89054-092-6), Corn Diseases (ISBN 0-89054-029-2), Cotton Diseases (ISBN 089054-031-4), Soybean Diseases (ISBN 0-89054-126-4), Peanut Disases (ISBN 0-89054-055-1), Pea Diseases (ISBNO-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 RoadSt. Paul, MN 55121. 2097USA.

CST. 406: GENETICS AND PLANT BREEDING–III

1. **Introduction:** Concept and objectives of Plant Breeding**.**
2. **Plant genetic resources:** Types of PGR, centre of origin of cultivated crop plants, genetic erosion & genetic vulnerability, conserving PGR, land races.
3. **Evolution of crop plants:** Pattern of crop evolution, evolution of some major cultivated crop plants-wheat, brassica, triticale.
4. **Reproductive biology and plant breeding:** Pollination mechanism in relation to crop improvement, determination of the mode of pollination, relevance of mode of reproduction.
4. **Genetic basis of crop improvement:** Population structure and gene frequency; effects of genes in quantitative inheritance; heritability and its role on genetic advance.
5. **Plant breeding methods for self-pollinated crops:** pedigree, single seed descent, bulk population and backcross methods.
6. **Plant breeding methods for cross-pollinated crops:** mass selection, back cross method, development of hybrid and synthetic varieties.
7. **Plant breeding methods for vegetatively propagated crops**: characteristics of clone, differences among clone, pure line and inbred, procedure and merits and demerits of clonal selection.
8. **Mutation breeding**: Generalised scheme for mutation breeding of polygenic and oligogenic traits, roll of mutation breeding in crop improvement, factors influencing mutation spectrum.
9. **Polyploid breeding**: Introduction and use of auto and allo-polyploids in crop improvement. Ploides line of same crops.
10. **Breeding for drought resistance**: Plant traits associated with drought resistance, scoring of resistance against drought.
11. **Stress breeding**: Important stress factors.
12. **Variety release and seed production:** Principles and practices relating to evaluation and release of new crop varieties, seed legislation, seed certification and seed testing.
13. **Breeding achievements of important crops in Bangladesh:** Rice, wheat, maize, jute, Sugarcane, mustard, groundnut, soybean, lentil, chickpea and vagetable.

14. **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.
15. **Haploidy in crop improvements:** Haploids in nature, induction of haploids and doubled haploids, their application in crop improvement, prospects and limitations.
16. **Distal hybridization:** Objectives, barriers, application in crop improvement-alien addition, alien substitution and transfer of segment of chromosomes, transfer of cytoplasm, prospects and limitations.
17. **Apomixis:** Origin, induction and its application in crop improvement.
18. **Quality seed:** Classes, production practices and maintenance of breeders' seeds.
19. **Plant Breeders' rights:** Requirements, farmer's privilege, breeders' exemption, benefits and disadvantages from PBR.

Books Recommended:

1. Allard , R.W. 1960. Principles of Plant Breeding. John Wiley and Sons, Inc. New York.
2. Bhojwani, S. S. and Razdan. M. K. 1983. Plant Tissue Culture: Theory and Practice. Elsevier Science Pub. Amsterdam.
3. Bhuiya. M. S.R. 1999. Udvid Projanan. 2nd edn. Bangla Academy. Dhaka (In Bangla).
4. Chopra, V. L. 1989. Plant Breeding: Theory and Practices. Oxford and IBH Pub., New Delhi.
5. Chopra, V. L. and Nasirn. A. 1990. Genetic Engineering and Biotechnology. Oxford and IBH Pub. , New Delhi.
6. David . W. R. 1995. Pollination of Cultivatied Plants in the Tropics, FAO, Rome.
7. Falconer, D,S. and Mackay . T. F. C. 1996. Introduction to Quantitative Genetics. Longman Essex, UK,
8. Ferhr, W.R. and Hadley, II.II. 1980. Hybridization in crop plants. American Soc. Agron. & Crop Sci. Soc. America, Madison.
9. Gamborg, OL. and Phillips. GC 1995. Plant cell. tissue and organ culture, Fundamental methods. Narosa Pub. House, New Delhi.
10. IPGRI. 2000. Cryopreservation of Tropical Plant Germplasm - Current Research Progress and Application. Florent FngcIlnann and Hiroko. Takagi, Rome.
11. Islam, M. A. 1998. Udvid ProJanan. Private Pub., BAU, Mymensingh (in Bangla).
12. Old, R. W. and Primrose. S. B. 1994. Principles of Gene Manipulation- An introduction to Genetic Engineering. Blackwell Scientific Publications. London. 5th edition.
13. PoehIman.J. M. and Sleeper. D. A. 1995. Breeding Field crops. Panima Pub. Cor. New Delhi.
14. Primrose. S. B. 1987. Modern Biotechnology. Blackwell Scientific Pub. London.
15. Sharma, J. R. 1994. Principles and Practice of Plant Breeding. Tata McGrawHill Pub, New Delhi.
16. Singh , B. D. 1986. Plant Breeding. Kalyani Publishers. India.
17. Bhuiya, M.S. R. 1999. Udvid Projonon. 2nd edn. Bangla Academy, Dhaka (In Bangla)
18. Chopra, V. L. 1985(ed.). Genetic manipulation for crop Improvement. Oxford IBH I Publishing Co. New Delhi.
19. Chopra, V.L. 1989. Plant Breeding: Theory and Practices Oxford and IBH Pub, New Delhi
20. Fehr, W.R. and H.H. Hadley. 1980. Hybridization in Crop Plants. American Society of Agronomy and Crop Science Society of America, Madisan, USA.
21. Sharma, J.R. 1994. Principles and Practice of Plant Breeding. Tala McGraw-Hill Publishing Company, New Delhi, India.
22. Singh. B.D. 2000. Plant Breeding, Kalyani Publishers, New Delhi, India.
23. Van der Have, D.J. 1979, Plant Weeding Persectives. Centre for Agricultural Publishing and Documentation, Wageningen, The Netherlands.
24. Virmani, S. S. 1994 (ed.). Hybrid Rice Technology: new developments and future prospects. International Rice Research Institute, Philippines.

CST. 407: AGRICULTURAL EXTENSION–III

1. **Extension Programme Planning:** Definition, types, principles and steps in extension programme planning, characteristics of a good programme. Definition of plan of work and calendar of work. Partnership programme in extension, different types of partnership programmes.
2. **People participation in agricultural extension programme:** Concept of people participation in extension work, objectives, positive and negative factors of people participation.
3. **Monitoring and Evaluation:** Meaning, definition, purpose and importance of monitoring and evaluation, types of evaluation, principles, steps of evaluation, contribution of evaluation to programme building, comparison between monitoring and evaluation,
4. **Extension organization:** Concept of organization and extension organization, objectives and features of extension organization, categories of personnel in extension organization, qualification and duties of extension administrator, specialists, supervisor and field workers. Basic concept of Non Government Organization and its types.Advantages and disadvantages of NGO.
5. **Management function of organization:** Concept of management, function, elements of management, management problems of an organization, concept of human resource development of an organization and its objectives, training and types of training, concept of decision-making, steps in decision-making, factors affecting decision-making, constraints in decision making in an extension organization.
6. **Socio-economic impact of modern agriculture:** Effects of chemical fertilizer, pesticide and modern practices of agriculture on environment.
7. **Sustainable agricultural development:** Concept, criteria and elements of sustainability in agriculture, managing and practicing towards environment friendly and sustainable agricultural development-Indigenous Technical Knowledge (ITK), Integrated Pest Management (IPM), Organic Farming (OM) and Integrated Crop Management (ICM).
8. **Technology transfer in agriculture and poverty alleviation:** Concept and feature of a technology, technology transfer process in Bangladesh, technology transfer model, constraints in technology transfer. Roles of BARC in technology transfer.
9. **Participatory approaches of agriculture and rural development:** Concept of participation, participatory technology development (PTD), Concept and characteristics of Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA).

Books Recommended:

1. Berlo, D.K.1960.The Process of Communication.New York: Holt, Rinehart and Winston Inc.
2. Kashem, M.A. 1992.Samprasaron Biggan.Dhaka: The Bangladesh Packing Press.
3. McQuail, D.and Windahl, S 1981.Communication Models for the Study of Mass Communication.London: Longman.
4. Sandhu, A.S.1993.Textbook on Agricultural Communication: Process and Methods.Kolkata: Oxford & IBH Publishing Co.PVT.LTD.
5. Singh, R, 1987.A Text of Extension Education.Sahityakala Prakashan, Ludhiana, India.

6. Supe, S.V.1983.An Introduction to Extension Education.Oxford and IBH Pub.Co.Pvt.Ltd.New Delhi.
7. Swanson, B.E.R.P.Bentz and A.J.Sofranko (1997).Improving Agricultural Extension: A Reference Manual.Rome: FAO of the United Nations.
8. Beal, G.M., Bholem, J.M.and Raudabaugh, J.N.1962.Leadershipo and Dynamic Group Action.Iowa State University Press.
9. Bernard, H.W.1975.Psychology of Learning and Teaching.McMillan Hill Books Co.N.Y.
10. Kreitlow, B.W., Aiton, E.W.and Lorrenes A.I. 1966. Leadership of Action in Rural Communities.Dauville, Illinois.The Interstate Printers and Pub.Inc.
11. Morgan, B.G., E.Holmes and C.L.Bundy.1963.Methods in Adult Education.Ulinois.The Interstate Printers and Pub.Inc.
12. Singh, R, 1987.A Text of Extension Education.Sahityakala Prakashan, Ludhiana, India.
13. †eMg, Gb.Gm. 1992, mvgvwRK M‡elYv cwiwPwZ, XvKv eyK nvDm|
14. Blackburn, D.J.(ed.).1994.Extension Handbook: Processes and Practice.Toronto Thomprson.Educational Pub.Inc.
15. Lv‡jK, G., Gb.Avi. miKvi Ges G. ingvb, 1988, mvgvwRK weÁv‡b M‡elYv c×wZ, evsjv GKv‡Wgx, XvKv|
16. Kothari, O.R. 1990.Research Methodology, Methods and Techniques. Wiley Eastern Ltd. New Delhi.
17. Raj, H.1987.Theory and Practice of Social Research.Surjee Pub.New Delhi.
18. iDd, †K.G. Ges Gjvnx, Gg. 1992, mvgvwRK M‡elYv c×wZ: ZË¡ Ges cÖ‡qvM, myR‡bly cÖKvkbv, XvKv|

CST. 408: POSTHARVEST TECHNOLOGY

1. **Seed drying:** concept, advantages, methods of seed drying; equilibrium moisture content and its determination; grain drying systems; forced air drying methods; seed dryers with their advantage and disadvantages.
2. **Seed cleaning:** principles and methods of Seed cleaning.
3. **Seed storage:** Principles, types of storage, safe conditions for seed storage, environmental factors affecting seed storage, factors affecting seed longevity and deterioration**.**
4. **Postharvest handling of horticultural crops:** Maturity types and stage of harvest; principles and methods of harvesting; culling, grading, triming, packing, transportation, and marketing of horticultural crops.
5. **Storage of horticultural crops:** Methods of storage; physiology of stored crops in fresh condition; factors affecting the physiological process of stored crops in fresh condition;
6. **Postharvest losses:** Assessment of quantitative, qualitative and nutritional losses; factors affecting postharvest losses; causes and control of postharvest losses.
7. **Processing and preservation of horticultural crops:** Importance, principles and methods of processing and preservation; Postharvest preservation and storage of important fruit crops grown in Bangladesh (mango, banana, litchi, guava, pineapple).
8. **Postharvest management of fruits:** Factors affecting shelf life of fruits, causes of spoilage of fruits and its remedies, grading, packaging, transporting and marketing of fruits
9. **Parboiling of paddy:** Concept, advantages, processing variables in parboiling, parboiling methods, physico-chemical changes during parboiling, effects of parboiling on milling, nutritional and cooking qualities of rice.
11. **Milling and Grinding:** concept, factors influencing milling, nutritional and cooking qualities of rice, parboiling methods; methods of husking; factors affecting the effectiveness of husking; grinding of cereals.

Books Recommended:

1. Agrawal, P.K.and Dadlani, M.1992.Techniques in Seed Sciences and Technology.South Asian Publishers Pvt.Ltd.New Delhi.
2. Dennis, S.Hill.1989.Pests of Stored Products and their Control.CBS Publishers & Distributors.New Delhi.
3. Bala, B.K.1997.Drying and Storage of Cereal Grains.Oxford & IBH Pub.Co.Pvt.Ltd.New Delhi.
4. BARC, 1992.Training manual on postharvest handling and marketing.
5. Chakraverty, A. 1995.Postharvest Technology of Cereals, Pulses and Oilseeds.Oxford & IBH Pub.Co.Pvt.Ltd.New Delhi.
6. Kader, A. 1992.Postharvest technology, Publication 331, University of California, Division of Agriculture and Natural Resources.
7. Wills, R.B.H., T.H. Lee; D. Graham, W.B. Mo Glasson and E.G.Hall.1881.Postharvest, an introduction to the physiology and handling of fruits and vegetables. AVI Publishing Co.Inc.Westport, Conn.

CST. 409: AGROFORESTRY

1. **Introduction to agroforestry:** Concept and definition, characteristics, components, history, historical development in Bangladesh, advantages and limitations, scope and traditional agroforestry system practiced in Bangladesh and its economics and social aspects.
2. **Classification:** Aagroforestry systems and practices.
3. **Introduction to Bangladesh forest:** Definition of forest, conventional forestry and forest community, forest types of Bangladesh having their characteristics, location and selected species and contribution to national economy.
4. **Social forestry:** Concept, definition, types, progress, prospects in Bangladesh, peoples participation and criticism, and constraints of social forestry.
5. **Choice of species in agroforestry system:** Factors affecting species selection; concept of multipurpose trees (MPTs); role of multipurpose trees and shrubs in agroforestry development; limitations in the use of multipurpose trees and shrubs; management of multipurpose trees.
6. **Species compatibility:** Species compatibility in different agro-ecological zones with special reference to salinity, drought, marshy and degraded land.
7. **Tree-crop interactions in agroforestry land use system:** Introduction to tree-crop interaction, types of interaction, environment and tree-crop interaction, methods of quantification of tree-crop interactions, resource sharing, comparison among the ideal agroforestry, common forestry and agricultural system.
8. **Homestead agroforestry:** Concept and definition, characteristics, classification, structure, principles, planning & layout, planning of homestead, Benefits, role, scope of homestead agroforestry.
9. **Farmland agroforestry:** Principles, practices, classification, planning, layout and management.
10. **Soil conservation and fertility management in Agroforestry system:** Definition of soil conservation, declination of soil fertility, types of soil degradation, causes of soil erosion, agroforestry for control of soil erosion, agroforestry practices for erosion control, agroforestry for maintenance of soil fertility, nutrient cycling in agroforestry system, hypothesis for soil agroforestry research in relation to soil conservation. Management of upland/hilly areas in Bangladesh: SALT model and its definition, advantages and disadvantage of SALT, steps of SALT and methods of conservation of eroded and degraded lands outside the SALT area.

Books Recommended:

1. Alam, M.K. and M.Mohiuddin 1992: Some Potential Multipurpose Trees for Homesteads in Bangladesh. BARC Winrock International.
2. Bhuiyan, A.A. 1994: Forest Land Agroforestry: The North Bengal Experience. BARC Winrok International.
3. Bhuiya, M.S.U., M.N. Bari, F. Ahmed, and G.M. Miah. 2000. Krishi Banyan.111, Irina Press, Fakirapul, Dhaka, P.A. to controller, BAU, Mymensingh.
4. Chowdhury, R.A., A.A. Bhuiyan and S.K. Bose. 1994. Agroforestry for the Degrade Sal Forest. Asia Pacific Agrotorestry Net work.
5. Chowdhury, M.K and Tej B.S Mahat 1993 (ed).Agroforestry Farming System linkages in Bangladesh.BARC-Winrock International.
6. Chundawat, B.S. and S.K.Gautam.1999.A Text Book of Agroforestry.Oxford & IBH publishing co.Pvt.Ltd., New Delhi.
7. CHTDB.1996.Cultivation in Hill by SALT Methods.Chittagong Hill Tract Development Board ,Khagrashari,
8. Dwivedi, A.P.1992.Agroforestry Principles and practices, Oxford & IBH publishing co.pvt.Ltd.New Delhi.
9. Haque, M.A. (ed) 1994: Village and Farm Forestry in Bangladesh VFFP Pub., BAU.Mymensingh and SDC.Dhaka.
10. Haradhan, B.1996.Technique of raising of saplings of wood, flower and fruit in the nursry.Situtuni Book House, Maddam Talpukur par, Commilla.
11. Kolesnikov, V.1971.The roof system, of plants, MIR Pub.Moscow.
12. Nair, P.K.R.1984.Soil Productiovity Aspects of Agrotorestry.Prudential Print.Ltd.Nairobi.
13. Nair, P.K.R.1989.Agroforestry systems in the Tropics.Foresty Sci.Vol.31.Dordrocht: Kukluwer Acad Pub.ICRAF, Nairobi.
14. Quddus, A.H.G.Ali, S.M.F.Bhuiyan, A.M.A. and M.Hossain, 1992.Greening the Hills, The Betagi-Pomora Agroforestry Experience.BARC-Winrock International.
15. Ramachandran and Nair.1993.Introduction to Agroforestry. ICRAF.
16. Torquebiau, E.1990: Agroforestry Concept.ICRAF, Nairobi
17. Young, A. 1989: Agroforestry for Soil Conservation.Science and Practice of Agroforestry 4.ICRAf Nairozi.
18. Wojtkowski, A.P.1998.The Theory and Practice of Agroforestry Design.Oxford & IBH publishing co.Pvt.Ltd., New Delhi.

CST. 410: AGRI-BUSINESS AND MARKETING

1. **Introduction to agribusiness:** Definition, objectives, importance of agribusiness system. Development of agribusiness enterprises in Bangladesh.
2. **Marketing Environment**: Nature of agricultural comodities, consumer demand, agricultural supply and matching, supply and demand in agricultural markets. Supply relationships in agricultural products; Cobweb model.
3. **Agribusiness management functions:** Planning, organization, motivation, implementation and control, application of management principles to agribusiness farms, analysis of finance, procurement, product development, processing and marketing of agribusiness products and related problems of agribusiness farms.
4. **Agribusiness management**: Developing the market plan, analyzing the market and managing the marketing, mix product, price, packaging and processing. Evaluating the agribusiness marketing programs.
5. **Development of agribusinesses in Bangladesh:** Problems and prospects, review of laws and infrastructural development affecting agribusiness operations in Bangladesh.

Books Recommended:

1. Drilon, J.D.1971: Introduction to Agribusiness Management, Asian Productivity Orgainizations, Tokyo.
2. Dowrey, W.D.and J.K.Trocke.1981: Agribusiness Management, McGraw-Hill International Book Co.London.
3. A.K.Sah: Functional Management for the Cooperatives.Rainbow Publications, Coimbatore-30, Tamilnadu, India.
4. Robert M.Fulmer, 1988: The New Management, 4th ed.Macmillan Publishing Company, New York-10022.
5. Turban & Meredith.1981: Fundamentals of Management Science; Business Publication Company Inc.Plano, Texas-75075, USA.
6. Cramer and Jensen.1991: Agricultural Economics and Agribusiness, 5 th ed.John Wiley & Sons, Inc.Singapore.
7. Wills Walter J.1979: An Introduction to Agribusiness Management, 2 nd ed.Danville, III.The Interstate Printers Publishers.
8. Seperich, Woolverton & Beierlein, 1994: A Introduction to Agribusiness Marketing.Prentice Hall Career & Technology.Englewood Cliffs, NJ 07632.

CST. 411: JOB ORIENTED COURSES

Quality Seed Production/Seed Science and Technology/Micro Propagation/Compost Production / Biofertilizer Production

Each Student shall have to take any one of the following Courses:

QUALITY SEED PRODUCTION

1. Concept of quality seeds.Classes of seed. Purity of seeds, Seed sampling.Seed testing.
2. Seed Act and Seed Certification.
3. Deterioration of genetic purity of a variety during its production cycle.
4. Agronomic principles of seed production - selection of suitable region, land, variety, sowing, isolation, roughing, nutrition, irrigation, harvesting, threshing, processing and drying.
5. Production technology of foundation and certified seeds of cereals, fibre, pulses, oil seed and tuber crop.

Books Recommended:

1. Chatterjee, B.N.and Maiti, S.1983.Rice Production Technology Manual.Oxford and IBH Pub.Co.Pvt.Ltd.India.
2. Kondap, S.and Upadhyay, U.C.1985.A Practical Manual on Weed Control.Oxford and IBH Pub.Co.Pvt.Ltd.India.
3. Singh, C.1989.Modern Techniques of Raising Field Crops.Oxford and IBH Pub.Co.Pvt.Ltd.India.
4. Agarwal, R.L.1986.Seed Technology.Oxford and IBH Pub.Co.New Delhi.
5. Principles of Seed Certification and Testing.Allied Pub.Ltd.New Delhi.
6. Seed Certification Agency. 1976. Seed Certification Manual. Ministry of Agriculture.Govt.of the Peoples Republic of Bangladesh.

SEED SCIENCE AND TECHNOLOGY

1. **Introduction to Seed Technology:** Definition, importance, classification, structure and development.
2. **Seed quality:** Characteristics of quality seed, importance of quality seed on crop production, procurement of quality seeds

3. **Dormancy of seeds:** Importance, causes, types and breaking of seed dormancy
4. **Seed germination:** Definition, process of germination, factors necessary for germination, seed viability and vigor, significance of seed vigor in crop production
5. **Seed rate and grading:** Concept, planting value of seed, seed Grading, factors affecting seed rate and seed grading
6. **Seed testing:** Objectives, seed sampling, determination of density, heterogeneity of seed lots and limit for defferent test, determination of seed purity, testing of seeds for viability, vigour, health and moisture
7. **Seed certification:** Objectives, fundamental concepts, organization and agency of seed certification, purposes of seed certification.
8. **Field and seed Inspection:** Objectives, general principles, methods of inspection, Postharvest inspection, specification for certification tag.
9. **Seed legislation and seed law enforcement:** Types of seed legislation, seed legislation in Bangladesh, regulatory legislation, seed law enforcement
10. Setellite seed testing laboratory.

Books Recommended:

1. Agarwal, R.L. 1986. Seed Technology. Oxford and IBH Pub. Co. New Delhi.
2. AOSA (Association of Official Seed Analysis).1978.Stone Printing Co.Michigan.USA.
3. Copeland, I.O.1976.Principles of Seed Science and Technology.Bargress Pub.Co.Minnessota. USA.
4. Hebblethwaite, P.D.1980.Seed Production.Butterworth.England.
5. ISTA (International SeedTesting Association).1976.International Rules for Seed Testing.Seed Science and Technology.Vol.4.p.3-49.
6. Justice, O.L.and Bass, I.N.1978.Principles and practices of seed storage.The science and Education Administration.USDA. Washington, D.C.
7. Principles of Seed Certification and Testing.Allied Pub.Ltd.New Delhi.
8. Seed Certification Agency.1976.Seed Certification Manual. Ministry of Agriculture.Govt. of the Peoples Republic of Bangladesh.

MICRO PROPAGATION

1. **Tissue culture:** Concept and historical backgrounds towards the development of tissue culture techniques.
2. **Methods of tissue culture:** Definition and dimension of plant tissue culture, cell culture, callus culture and organ culture, meristem culture and production of pathogen-free plants.
3. **Tissue culture medium:** Its components, types and importance.
4. **Somaclonal variation**: Origin and causes of somaclonal variation, why and how somaclones can be used for the improvement of plant.
5. **Anther/pollen culture:** Production of haploids and its utilization in plant breeding.
6. **Cell culture:** Growth pattern of cells suspension culture and importance of cell suspension.
7. **Cryopreservation:** Definition, scope, different steps, merit, demerit and its impact on germplasm conservation.
8. **Tissue culture techniques and biotechnology:** Utilization and scope of plant cell and tissue culture techniques in plant biotechnology.

Books Recommended:

1. 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.

2. Adriance and Brison, 1955.Propagation of Horticultural Plants.McGraw Hill Book Company, New York.
3. De, K.K.1992.An Introduction to plant tissue culture, New Crntaral Book Agency, Calcutta.
4. Hartmann, H.T., D.E.Kester and F.T.Davies Jr.1990 plant propagation principle and practices.Prentice-Hall, Iner, Editions.
5. Stephen, H.H.2003.Molecular Genetics of Plant Development. Cambridge Univ.Press.
6. Mukhopadhyay, S.1995.Commercialization of micropropagated Plants in India. New Deihi.

COMPOST PRODUCTION

1. Importance, scope and resources available for composting.
2. **Recycling of farm wastes:** direct incorporation, mulching and composting.
3. **Conversion of wastes into compost:** methodology, rating of substrates; physical and chemical characteristics of city solid wastes and functioning of mechanical compost plants.
4. **Enrichment of compost:** Role of organic and inorganic inputs, standard preparation of enriched composts.
5. **Phospho compost:** Preparation and evaluation.
6. **Vermicompost:** Methods of vermicomposting in a pit; nutrient content of vermicompost.

Books Recommended:

1. De, G.C.1989.Fundamentals of Agronomy, Oxford and IBH Pub.New Delhi.
2. Pearson, L.C.1973.Principles of Agronomy.East-West Press, New Delhi.
3. KzÏym, Gg.G. Ges Gg.Gb.AvB. ZvjyK`vi 1993, K…wlZ‡Ë¡i †gŠjbxwZ, evsjv GKv‡Wgx, XvKv|

BIO-FERTILIZER PRODUCTION

1. Scope, definition, type and arena of biofertilizer, microorganisms used as biofertilizers.
2. *Rhizobium* inoculants for leguminous crops.
3. *Azotobacter* inoculants and *Azospirillum* inoculants.
4. Photosynthetic biofertilizers for rice- Cyanobacteria and *Azolla*.
5. Phosphate solubilizing microorganisms as biofertilizer.
6. Vesicular and Asbascular Mycorrhiza fungi.

Books Recommended:

1. Alexander, M.1977. Introduction to Soil Microbiology.John Wiley and Sons.New York.
2. Burton, J.C.1967.*Rhizobium* Culture and Use.In Microbial Technology.Ed.H.J.Peppler, Reinhdd Pub.Corp.New York.
3. Subba Rao, N.S.1977.Soil Microorganisms and Plant Growth.Oxford and IBH Pub.Co.New Delhi.
4. Subba Rao, N.S.1979.Recent Advance in Biological Nitrogen Fixation.Oxford and IBH Pub.Co.New Delhi.
5. Subba Rao, N.S.1995.Biofertilizers in Agriculture and Forestry.Oxford and IBH Pub.Co.New York.
6. Tisdale, S.L., Nelsone, W.L.and Beaton, J.D.1990.Soil fertility and fertilizers.McMillan Pub.Co.New York.
7. Venkataraman, G.S.1972.Algal Biofertilizers and Rice Cultivation.Today and Tomorrow Printer and Publishers, New Delhi.

PRACTICAL COURSES

B.Sc.Ag. (Hons) Part-IV

CST. 412: AGRONOMY –IV

1. **Project paper:** Conduction of a simple experiment to study the effect of agronomic practices on crop production and to prepare a report on the same.
2. Study of farm records and their maintenance.
3. Preparation of a cropping scheme.
4. Laying out an agricultural farm.
5. Conductoin of a crop cutting experiment.
6. Preparation of a crop report:
7. Study of land utilization and crop statistics of Bangladesh.
8. Preparation of complete yearly budget of a farm.
9. Raising a forage crop in individual plot.

CST. 413: SOIL SCIENCE–IV

1. Problems and calculation about different fertilizers.
2. Rapid test of NPK in soil and plant samples using kits.
3. Determination of total N in soil and plant samples by Kjeldahl method.
4. Determination of available P by Olsen method.
5. Determination of exchangeable K in soil by ammonium acetate method.
6. Determination of available soil S by calcium chloride extraction method.
7. Determination of zinc in soil by HCL extraction method.
8. Determination of available soil B by hot water method.
9. Effect of chemical, organic and/or bio-fertilizers on growth and yield of (selected) crop (field /pot experiment)
10. Studing root growth of different crops under varied soil conditions.

CST. 414: HORTICULTURE – IV

1. Field visit for identification of common fruits and plantation crops in different areas of Bangladesh and peparation of album.
2. Morphological features of important fruit plants.
3. Preparation of different planting plans for orchards.
4. Practices on layout, planting, manuring, fertilizing and other cultural operations of orchards.
5. Practices on common nursery techniques including preparation of nursery bed, raising of fruit saplings in the nursery bed and pots.Accelerating seed germination.Preparation and application of starter and hormone solutions.
6. Practicing vegetative propagation methods of common fruit plants of Bangladesh.
7. Pruning and traning practices of different important fruit plants.
8. Costing exercises on mango, papaya, banana, pineapple and baukul.
9. Performance records of some selected fruit tree.

10. Visiting important of major fruit growing region in Bangladesh.

    Market evaluation and observation of some selected fruit commonly produced in Bangladesh.

CST. 415: ENTOMOLOGY–III

1. **Pesticides:** Study of commonly used pesticides for controlling insects, mites and rodents. Precautionary measures to be taken during handling and using pesticides.
2. **Economic Entomology:** Survey of the major pests of rice, wheat, sugarcane, jute, cotton, vegetables, fruit, storedgrain and preparation of a report indicating their nature of damage and recommended control measures.
3. Development of a programme of integrated pest management (IPM) for any one of these major crops.
4. Identification of insects carrying disease organism of major crops in Bangladesh.
5. Methods of crop-loss assessment in pest infested fields and estimation of economic threshold level.
6. Rearing techniques of industrial insects.
7. Visit to important places having impact of apiculture, sericulture and lac culture.
8. Identification of beneficial insect and mites.

CST. 416: PLANT PATHOLOGY–III

1. Methods of collection and preservation of diseased plant-materials.
2. Preparation of herbarium of diseased specimen of important crops.
3. 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, alternaria leaf spot of cabbage.
   iv. Alternaria leaf spot and stemphylium blight of onion.
   v. Powdery and downy mildew of cucurbits.
   vi. Rhizopus fruit rot of jackfruit and kul.
   vii. Brown spot and frogeye leaf spot of tobacco.
   viii. Antracnose and taphrina leaf spot of turmeric.
   ix. Antracnose 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, bunchytop,
   vi. Anthracnose and fruit rot of banana.
   vii. Anthracnose, stem end rot and mosaic of papaya.
   viii. Wilt of guava
   ix. Scab, canker, die back and greening of lemon.

x. Tobacco mosaic.
xi. Blister blight and grey blight of tea.
xii. Foot rot and leaf rot of betelvine.
xiii. Phanerogamic parasites (*Cuscuta, Loranthus* and *Orobanche*).
xiv. Damping-off and seedling blight.

4. **Seed health testing:** Dry inspection, incubation methods (Blotter and agar plate methods) and growing on test.
5. **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.
6. **Field excursion for plant disease study:** Each student is required to submit a comprehensive report on the prepared herbarium, spray experiment and field excursion.

CST. 417: GENETICS AND PLANT BREEDING–III

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 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 significan and mean separation.
   b) Plant characters association -correlation and regression analysis.
   c) Estimation of 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 demostration of embryo culture.
5. Demonstration of mutants, polyploids and hybrids in research fields.
6. Haploid production through anther culture and wide crossing.
7. Interspecific hybridization.
8. Study on flow chart representing various breeding methods.
9. Evaluation and maintenance of parental lines in hybrid seed production.
10. Study visit at different crop breeding stations followed by report.

CST. 418: AGRICULTURAL EXTENSION–III

1. Diagnosis of the rural problem, determination of objectives, and goals, and developing a plan of work and calendar of work.
2. Identification of farmers' need through using of participatory methods.

3. Preparation of a training schedule.
4. A case study and focus group discussion (FGD) about use of ITK.
5. Identification and exploring the use of medicinal plants by the farmer in human and animal health.
6. Methods and procedure of office management.
7. Preparation of a logical framework for an extension programme.
8. Preparation of extensive programme on agricultural development and socio-economic condition in Bangladesh.
9. Each student will be assigned with at least two community based organizations- one from GO and other from NGO, write term paper as assigned by the class teacher.

CST: 419: AGROFORESTRY

1. Identification of multipurpose trees species and their seeds.
2. Study of silvans feature of multipurpose tree species commonly used in Bangladesh.
3. Study on the development of live fences.
4. Preparation and establishment of a forest nursery for raising samplings and studing of different trees species.
5. Preparation and establishment of a poly-bag nursery and methods of planting of a sapling raised in poly-bag nursery.
6. Study of tree shoots and roots management and incising of curve stem in crop field.
7. Study of root spread and root mass of trees in crop field and homestead
8. Determination of growth and biomass yields of tree crops.

CST. 420: JOB ORIENTED COURSES

QUALITY SEED PRODUCTION

1. a) Sampling of seed for testing different quality:

   i) Purity, ii) Moisture, iii) Viability, iv) Germination, v) Dormancy, vi) Vigour, vii) Health.

2. Production Technology of quality seeds of Rice / Maize / Wheat / Jute / Potato/ Red gram/ Soybean / Black gram / Green gram / Bengal gram/ Lentil / Mustard / Sesame / Groundnut vagetables / flowers (according to seasonal availability and individual plot to each student).
3. Calculation of cost production and returns from production.
4. Processing of seeds: Cleaning, grading, drying, treating, Packaging.

SEED SCIENCE AND TECHNOLOGY

1. Study on monocotyledonous and dicotyledonous seed structure.
2. Technique of seed sampling.
3. Testing of seed for moisture, purity, germination, viability and vigor.
4. Determination of seed rate of crops.
5. Practicing of seed grading.
6. Treatment of seed before sowing.
7. Study on seed processing equpments.

MICRO PROPAGATION

1. Preparation of media and stock solution for growth regulators.
2. Collection, surface sterilization, preparation and inoculation of explants.
3. Establishment of callus and induction of somatic embryogenesis and organogenesis.
4. Determination of appropriate stages of anther and pollen for culture initiation and induction of haploid plants.
5. Determination of growth index by callus culture and bioassay system for auxin and cytokinin.
6. Estimation of different growth parameters for evaluation of suitable media composition using proliferation shoot cultures.
7. Embryo and organ culture.
8. Evaluation and interpretation of experimental data.

COMPOST PRODUCTION

1. Identification and selection of organic wastes.
2. Agro-industrial, industrial, city, sewarage and sludge for composting.
3. Estimation of C; N of wastes from farm, agro-industrial, slaughter wastes, city garbage, sewarage - sludge etc.to determine their suitability for composting.
4. Demonstration for rapid composting.
5. Types and design of compost pit.
6. Determining the amount of (i) phosphate rock and (ii) pyrite.
7. Vermicomposting: Lay out of a vermipit, selection of wastes. Analysis of vermicompost.
8. Calculation of cost of production, cost benefit ratio.
9. Visit to (i) Sewage treatment plant, (ii) Effluent treatment plant, (iii) Compost plant.
10. *In vitro* vermicomposting (Bio conversion in soil).

BIO-FERTILIZER PRODUCTION

1. Colonial characterization of important biofertilizer producing bacteria, cyanobacteria and fungi.
2. Microscopic examination of important diazotrophic Cycanobacteria.
3. Determination of heterocysts frequency in Cyanobacteria.
4. Isolation of *Azolla* and examination of *Anabaena - Azolla* symbiont.
5. Microbiological tests: Congo red test, Hofer's alkaline broth test, lactoseagar test, Hydrolysis of starch, Fermertation of glucose, NO_3 reduction.
6. Isolation and charactarization of *Rhizobium* from root nodules of leguminous plants.
7. Isolation and charactarization of *Azotobacter* from roots and diazotrophic Cyanobacteria from rice soil.
8. Isolation and charactarization of *Azospirillium* from roots and diazotrophic Cyanobacteria from rice soil.
9. Estimation of nitrogen from cultures of bacteria, Cyanobacteria and *Azolla*.
10. Demonstration and practice for the preparation of Agar, Broth and carrier based inoculants of *Rhizobium, Azotobacter* and phosphate solubilizing agents.
11. Mass production technique of Cyanobacterial *Rhizobium, Azotobacter, Mycohrriza* etc.
12. Culture of *Azolla.*
13. Setting up a microbial laboratory.

The End