

Year 2: Term 2

Course Code	Course Title	Credit Hour
AG 2201	Field Crop Production-I Theory	2.0 3.0
AG 2202	Field Crop Production-I Lab	1.0
AG 2203	Fundamentals of Entomology-Theory	3.0
AG 2204	Fundamentals of Entomology- Lab	1.0
AG 2205	Nuclear and Agro Industrial Chemistry-Theory	2.0
AG 2206	Nuclear and Agro Industrial Chemistry- Lab	1.0
AG 2207	Plant Morphology and Embryology-Theory	3.0
AG 2208	Plant Morphology and Embryology- Lab	1.0
AG 2209	Cytology and Cytogenetics-Theory	2.0 3.0
AG 2210	Cytology and Cytogenetics- Lab	1.0
AG 2211	Fundamentals of Extension, Leadership and Motivation -Theory	3.0
AG 2212	Fundamentals of Extension, Leadership and Motivation - Lab	1.0
AG 2213	Course viva	1.0
Total	22.0	24

Course code : AG 2201
Course Title : Field Crop Production-I - Theory
Course type : Major
Number of credits : 3
Total marks : 100

Objectives

- Describe production technology and quality improvement of industrial crops
- Provide knowledge on management of water, fertilizer, organic matter and plant stress
- Impart knowledge on crop growth factors

Course content

Crop Growth Factors: Factors affecting growth, development and yield of crops.

Water Management: Water use efficiency under irrigated farming. Water management in dry land farming. Irrigation scheduling.

Fertilizer Management: Balanced fertilization. Fertilizer management in relation to varietal characteristics, growth phases, cropping systems and irrigation.

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

- **Cereal crops:** Rice, wheat, maize, barley and millets.
- **Sugar crops:** Sugarcane and sugarbeet.
- **Pulse crops:** Lentil, mungbean, grasspea, pea, chickpea, pigeonpea and black gram.

- **Narcotic crops:** Tobacco.
- **Beverage Crops-** Tea, coffee.

Learning outcomes

- Explain the production technology and quality improvement of industrial crops.
- Describe the management procedure of water, fertilizer, organic matter and plant stress.

Teaching strategy: • Lecture • Video clips • Tutorial

Assessment strategy: • Written test • Quiz • Assignment • Presentation

References

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 Edition, McMillan Pub. Co. Inc., New York.
4. Shyte, R.O. 1980. Crop Production Environment. Faber and Faber Ltd. 24, Russel Square, London, W.C.I.
5. Thakur, C. 1979. Scientific Crop Production. Volume I and II. 3rd Edition. Metropolitan Book Co. Ltd. I. Netaji Subhash Maeg, New Delhi 11002, India.

Course code	: AG 2202
Course Title	: Field Crop Production-I- Lab
Course type	: Major
Number of credits	: 1
Total marks	: 100

Objectives

- Introduce the students with different field crops and their growth phases.
- Demonstrate the fertilizer and manure applications and composting methods.
- Enable the students to identify and classify seeds of different field crops.
- Make the student familiar with different aspects of water, fertilizer and organic matter management during crop production.
- Help the students getting an in-depth knowledge on managing different stresses that affect growth, development, yield and quality of field crops.
- Enhance students' knowledge on crop production, post-harvest processing technology and computation of production cost of cereal, pulse, sugar, narcotic and green manuring crops.

Course content

1. Study of plant density on the growth and yield of a crop grown in students' plot and preparation of report.
2. Preparation of nurseries for raising seedlings of rice and tobacco.

3. Practicing different methods of planting sugarcane.

4. Practicing irrigation scheduling for a crop.

5. Computation of production cost of crops.

Learning outcomes

- Understand the role of different factors on growth, development and yield of field crops
- Describe the management aspects of water, fertilizer and organic matter during crop production
- Manage different stresses that affect growth, development, yield and quality of field crops state the production technology and post-harvest processing of cereal, pulse, sugar, narcotic and green manuring crops.
- Elucidate the production cost of cereal, pulse, sugar, narcotic and green manuring crops.

Teaching strategy: • Lecture • Question and answering • Tutorials

Assessment strategy: • MCQ • Short question • Essay type question • Assignment

References

1. Ancha Srinivasan. 2006. Handbook of Precision Agriculture – Principles and Applications. Food Product Press, an imprint of The Haworth Press, Inc. New York.
2. Gupta, U.S. 2005. Physiology of Stressed Crops: nutrient relations. Science Pub., India.
3. Martin, J.H., Waldren, R.P. and Stamp D.L. 2006. Principles of Field Crop Production, 4th Ed., the MacMillan Co., New York.
4. Reddy, S. R. 2006. Agronomy of Field Crops. Kalyani Publishers, Ludhiana, New Delhi, Hyderabad, Kolkata, India.
5. Singh, S. S. 2003. Crop Management under Irrigated and Rainfed Conditions. Kalyani Publishers, Ludhiana, New Delhi, Hyderabad, Kolkata, India.
5. Thakur, C. 1979. Scientific Crop Production. Volume I and II. 3rd Edition. Metropolitan Book Co. Ltd. 1, Netaji Subhash Marg, New Delhi 11002, India.

Course code : AG 2203

Course Title : Fundamentals of Entomology-Theory

Course type : Major

Number of credits : 3

Total marks : 100

Objectives

- Provide taxonomic knowledge for classification of insects and arachnids
- Acquaint students with insects' morphological structures and their functions

- Develop skills to categorize insects, mites and spiders in different orders and families
- Impart knowledge on physiology, reproduction and neurobiology of insects

Course content

Insecta and Arachnida: General characters and classifications.

Insect morphology: External anatomy of insect. Antennae, legs, mouthparts, wings, stridulatory organs and integument in insects.

Insect taxonomy: Diagnostic characters and economic importance of orders and families of insects, mites and spiders of agricultural importance.

Insect physiology: Insect nutrition. Endocrine glands- neurosecretory cells, corpora cardiaca, corpora allata and thoracic glands. Insect hormones- types of hormones and their functions. Moulting- Process of moulting. Metamorphosis- types of metamorphosis, hormonal control of metamorphosis.

Insect neurobiology: Neuron- Sensory neuron, motor neuron and associated neuron, reflex arc. Sense organs- mechanoreceptor, chemoreceptor, photoreceptor, auditory receptor, temperature and humidity receptor. Nervous system- central, peripheral and sympathetic nervous system.

Insect reproduction: Reproductive system and types of reproduction.

Learning outcomes

- Identify insects and arachnids
- Explain insects morphological structures and features
- Describe systematic classification of insects and arachnids with their agricultural importance
- Outline physiological process of insects
- Describe neurological structures and functions in insects
- Illustrate insect reproduction

Teaching strategy: • Lecture • Videos • Presentation • Self-study/E-learning
• Tutorial

Assessment strategy: • Written test (Short, descriptive type question) • Quiz test
• Assignment

References

1. Borror, D.J., Delong, D.M. and Triplehorn, C.A. 1976. An introduction to the study of insects. Holt Rinehart and Winston, New York. Gillot, C. 1995. Entomology. Plenum Publ. Corp., New York.
2. Richards, O.W. and Davis, R.G. 1977. Imm's general textbook of Entomology. Vols. I & II., Chapman and Hall, London.
3. Blum, M.S. 1985. Fundamentals of insect physiology. John Wiley & Sons, New York.
4. Fiennes, R. N. 1972. Biology of nutrition. Pergamon Press, Oxford and New York.
5. Frederik, H. and Jhout, N.I. 1994. Insect hormones. Intercept Ltd., London.
6. Mani, M.S. 1990. General Entomology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Course code	: AG 2204
Course Title	: Fundamentals of Entomology- Lab
Course type	: Major
Number of credits	: 1
Total marks	: 100

Objectives

- Illustrate insects, mites and spiders, and their appendages
- Demonstrate the preparation of temporary and permanent slides of insect appendages
- Explain collection and preservation of insect specimen
- Demonstrate dissection and display of anatomical organs of insect

Course content

1. External anatomy of insect.
2. Study of various types of antennae, legs, mouthparts and wings of insects.
3. Techniques of preparation of temporary and permanent slides of insect appendages.
4. Internal anatomy of grasshopper, cotton bug and a lepidopteran insect.
5. Methods of collecting, killing, preparing and preserving of insects.
6. Identification up to family of insects, mites and spiders of economic importance in Bangladesh.

Learning outcomes

- Explain external and internal anatomical features of insect
- Illustrate different appendages of insects with modifications
- Prepare slide for insect studies
- Collect and preserve insects
- Identify economically important insects, mites, and spiders relevant to agriculture

Teaching strategy: • Lecture • Video clip • Self-study/E-learning • Demonstration

Assessment strategy: • Written test (MCQ, Short type question) • Quiz test
• Assignment • Interview

References

1. Borror, D.J., Delong, D.M. and Triplehorn, C.A. 1976. An introduction to the study of insects. Holt Rinehart and Winston, New York.
2. Blum, M.S. 1985. Fundamentals of insect physiology. John Wiley & Sons, New York.
3. Gibb, T and Oseto, C. 2005. Arthropod Collection and Identification- Laboratory and Field Techniques.
4. Nayar, K. K., Ananthakrishnan, T. N. and David, B. V. 1985. General and applied Entomology. Tata McGraw - Hill Publ. Co. Ltd., India.
5. Ross, H. H. 1965. A text book of Entomology. John Wiley, New York.
6. Saxena, S. C. 1996. Biology of insects. Oxford & IBH Publishing Company.

Course code	: AG 2205
Course Title	: Nuclear and Agro-industrial Chemistry- Theory
Course type	: Major
Number of credits	: 2
Total marks	: 100

Objectives

- Acquaint the students with the theoretical and applied knowledge on manufacturing, processing, quality control, storage and use of different agroindustrial crops
- Explain the chemistry, manufacturing technologies and quality of fertilizers
- Provide basic knowledge on nuclear chemistry to apply radioisotopes in different fields of agriculture
- Describe the suitability of water for different usage

Course content

Nuclear Chemistry:

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

Fertilizer Chemistry:

Manufacturing technology: Choice and purification of feedstocks, manufacturing process of urea, source and manufacturing of OSP, TSP and DAP, types and composition of potash ores, mining, beneficiation of sylvinitic ores, secondary and micronutrient fertilizers, mixed, compound, liquid and controlled release fertilizers.

Properties of fertilizers, quality control, specifications, compatibility and comparison of commonly used fertilizers.

Chemistry and Technology of Agro industrial Products:

Rubber: Tapping system, composition and coagulation of latex. Classification and properties of synthetic rubber.

Sugar: Condition and quality of sugarcane, manufacture of plantation white sugar, industrial utilization of sugar mill by products.

Tea: Ideal condition for tea cultivation, manufacturing process and change of chemical composition in tea leaves, aroma, tea infusion and liquor quality of tea. Water Chemistry: Sources, quality assessment and criteria for drinking, irrigation, poultry, livestock, aquaculture and industrial usage of water, ionic toxicity and plant tolerance, characteristics of water bodies, chemical models of water system and water treatment.

Learning outcomes

- Explain manufacturing, processing, quality control, storage and use of different industrial crops.
- Enumerate the chemistry, quality and compatibility of fertilizers.
- Describe the production technology of fertilizers.
- Explain nuclear reactions, properties, safety and absorption of radiations.
- Identify suitable radiation detection techniques and justify radioisotope applications in different fields of agricultural research.
- Categorize water based on quality parameters to recommend water for different usage.

Teaching strategy: • Lecture • Video clip • Field trip

Assessment strategy: • Short question • MCQ • Assignment

References

1. Ayers, R.S. and Westcot, D.W. 1985. Water Quality for Agriculture. FAO Irrigation and Drainage Paper 29 Rev. Rome, Italy.
2. Comar, C.L. 1985. Radioisotopes in Biology and Agriculture-Principles and Practices. McGraw-Hill Book Company, Inc. New York.
3. Das, R.K. 1987. Industrial Chemistry, Part-2, Kalyani Publishers, New Delhi, India.
4. Dhingra, K.C. 1984. Hand Book on Rubber and Rubber Goods Industries. Small Industry Research Institute, New Delhi.
5. Havlin, J.L.; Beaton, J.D.; Tisdale, S.L. and Nelson, W.L. 1999. Soil Fertility and Fertilizers, 6th edn. Prentice-Hall, Inc., Upper Saddle River, New Jersey, USA.
6. Hignett, T.P. (ed.) 1985. Fertilizer Manual. International Fertilizer Development Center (IFDC), Alabama, USA.
7. APHA (American Public Health Association). 1995. Standard Methods for the Examination of Water and Wastewater. 19th edn. Water Environmental Federation, Washington, DC 20005, USA.
8. Barnes, A.C. 1974. The Sugarcane. Intersciences Publishers Inc; New York.
9. Chase, G.D. and Rabinowitz, J.R. 1984. Principles of Radioisotopes Methodology. Burgess Publishing Company; USA.
10. Eden, T. 1987. Tea. Longmans, Great Britain.

Course code	: AG 2206
Course Title	: Nuclear and Agro-industrial Chemistry-Lab
Course type	: Major
Number of credits	: 1
Total marks	: 100

Objectives

- Calibration and operation of analytical and nuclear equipments.
- Develop skills on sampling and analyses of fertilizers to identify commonly used fertilizers and their adulterations.
- Categorize water on the basis of physical and chemical properties.
- Acquaint with radioisotopes applications in institutional installations.

Course content

1. Instructions for the use of laboratory chemicals, glassware's and their safety measures.
2. Operation of laboratory equipment's
 - a. pH meter b) Electrical conductivity meter c) Spectrophotometer d) Flame emission spectrophotometer and e) Atomic absorption spectrophotometer
3. 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.
4. Water analysis: Surface, ground and rain waters for dissolved constituents and nutrients.

Learning outcomes

- Operate and calibrate laboratory equipments.
- Collect and process water, plant and fertilizer samples.
- Analyze manures and fertilizers for quality control.
- Determine water quality parameters for different usage.
- Apply radioisotopes in agricultural research.

Teaching strategy: • Lecture • Demonstration • Experiment • Field trip

Assessment strategy: • Short question • MCQ • Experiment • Assignment

References

1. APHA (American Public Health Association). 2012. Standard Methods for the Examination of Water and Wastewater. 22nd edn., AWWA and WEF,
2. Ayers, R.S. and Westcot, D.W. 1985. Water Quality for Agriculture. FAO Irrigation and Drainage Paper 29 Rev. Rome, Italy.
3. FRG. 2012. Fertilizer Recommendation Guide. Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka-1215. 274p.
4. Jones, U.S. 1979. Fertilizers and Soil Fertility. Reston Publishing Com.
5. Kalra, Y.P. 1998. Handbook of reference methods for plant analysis. CRC Press Taylor & Francis Group, Broken Sound Parkway, NW.

6. Tandon, H.L.S. (ed.). 2013. 2nd edn., Methods of Analysis of Soils, Plants, Waters, Fertilizers and Organic Manures. Fertilizer Development and Consultation Organization, New Delhi, India.

Course code	: AG 2207
Course Title	: Plant Morphology and Embryology- Theory
Course type	: Major
Number of credits	: 3
Total marks	: 100

Objectives

- Describe detail morphological, anatomical and embryological features of crops in relation to plant taxonomy

Course content

External morphology of the following crops:

- 1) Mustard, 2) Jute, 3) Tobacco, 4) Groundnut, 5) Cotton, 6) Onion, 7) Rice, 8) Wheat, 9) Tea, 10) Rubber and 11) Betel leaf.

Cell: Concept, structures and ultra-structures of protoplasmic components of cell, functions of important organelles.

Cell wall: Components and composition of cell wall, patterns of thickening, cell wall organization, plasmodesma, pit structures of simple and bordered pits and their functions, primary pit field.

Tissue: 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 systems- epidermal, procambial & vascular, epidermal appendages. Variations of different tissues in response to stresses and their defense mechanisms against insect pests and diseases.

Primary structure: Concept of primary growth, structures of root and stem of monocot and dicot plants, structures of isobilateral and dorsiventral leaves.

Secondary structure: Concept of normal and anomalous secondary growth, activities of typical vascular cambium, formation of periderm and its functions.

Anatomy of field crops: 1) Rice, 2) Sugarcane, 3) Jute, 4) Cucurbit, 5) Mustard and 6) Lentil.

Embryology: Concept of sporogenesis and gametogenesis in cryptogams, microsporogenesis and microgametogenesis, megasporogenesis and megagametogenesis, pollination, fertilization, parthenogenesis, development of embryo, endosperm, seed and fruit, in-vitro fertilization and embryo culture.

Distinguishing characters of the following families: 1) Gramineae, 2) Leguminosae, 3) Solanaceae, 4) Cucurbitaceae, 5) Compositae, 6) Umbelliferae, 7) Rutaceae, 8) Anacardiaceae, 9) Moraceae, 10) Orchidaceae and 11) Palmaceae.

Economically important plants: Fibre, oil, timber, medicinal, rubber, narcotic and beverage yielding plants & their products of economic importance.

Learning outcomes

- Understand descriptors of different crop plants for identification, compare and contrast.
- Illustrate the structure, function of cells and tissues of roots and shoots
- Compare and contrast internal structures of field crops for varietal identity.
- Describe embryogenesis & its relation to embryo, endosperm, seed and fruit development.
- Explain techniques of somatic embryogenesis in-vitro and its application in crop improvement
- Describe field recognition features to distinguish different crop families for plant classification and biodiversity management
- Describe medicinal plants, their functions and industrial uses.

Teaching strategy: • Lecture • Demonstration and practice • Group discussion

Assessment strategy: • MCQ • Short question • Practical job • Assignment

References

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. . 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. 1965. Plant anatomy. John Wiley, New York.
8. Esau, K. 1977. Anatomy of seed plants. John Wiley, New York.
9. Fahn, A. 1967. Plant anatomy. Pergamon Press, Oxford.
10. Gupta, R.K. 1961. Text book of systematic botany. 5th ed. Atea Ram Pub., Delhi.

Course code	: AG 2208
Course Title Plant	: Morphology and Embryology- Lab
Course type	: Major
Number of credits	: 1
Total marks	: 100

Objectives

- Equip the students with practical knowledge and understanding of crop morphology.
- Demonstrate ethno-botany and economically important plants.

Course content

External morphology of the following crops and their relatives: Mustard, onion, groundnut, lentil, brinjal, jute, cotton, cucurbit, sunflower, rice, wheat, maize, sugarcane, coriander, mango, guava, jackfruit, pineapple.

Slide preparation: Sectioning, staining and mounting, temporary and semi-permanent slides, demonstration of microtome and maceration techniques.

Demonstration of the following:

1. Nucleus, nucleolus, plastids, compound middle lamella, primary wall, secondary wall, thickening of cell wall;
2. Parenchyma, collenchyma, sclereid, fibre and secretory cells both in transverse and longitudinal sections/macerated materials;
3. Tracheid, vessel, wood fibre, wood parenchyma, sieve cell, sieve tube, companion cell, bast fibre and epidermal appendages and
4. Structure of anther, pollen grain, pollen germination, hand pollination technique, ovary, ovule and placenta.
5. Internal structures of isobilateral and dorsiventral leaves.

Identification: Monocot and dicot seeds and seedlings.

Anatomy of field crops: Stem and root of maize, rice, cucurbit, groundnut, countrybean and jute; leaves of monocot and dicot plants. Preparation of herbarium sheet.

Learning outcomes

- Identify plant families to compare and contrast the external morphology of different crops
- Prepare temporary and permanent slides for microscopy
- Identify cells, cell organelles, plant tissues, pollen, placenta and leaves
- Identify seeds and seedlings of monocot and dicot plants
- Illustrate anatomical features of roots, leaves and stems of crops
- Prepare herbarium sheets

Teaching strategy: • Lecture • Demonstration and practice • Group discussion

Assessment strategy: • MCQ • Short question • Practical job • Assignment

References

1. Brian, C. 2005. Botany for Gardeners. Timber Press, Inc., Cambridge.
2. Esau, K. 1965. Plant Anatomy. John Wiley, New York.
3. Henry, R. J. 2005. Plant Diversity and Evolution Genotypic and Phenotypic Variation in higher Plants. CABI Pub., Cambridge.
4. Lersten, N. R. 2004. Flowering Plant Embryology. Blackwell Pub., Oxford.
5. Pandey, B.P. 2000. Economic Botany. 6th ed. S. Chand & Co., New Delhi.
6. Purseglove, J.W. 1985. Tropical Crops. Vol. 1 & 2. Longmans, London.
7. Simpson, M.G. 2010. Plant Systematics. 2nd ed., Elsevier Acad. Press, New York.

Course code	: AG 2209
Course Title	: Cytology and Cytogenetics - Theory
Course type	: Major
Number of credits	2 3
Total marks	: 100

Objectives

- Explain the genetic mechanisms involving linkage-crossing over, multiple allelism, sex determination and extra nuclear inheritance
- Provide knowledge on mutation, mutagens and their effects
- Describe the meiotic behaviors and cytogenetic consequences of genetic variations
- Deliver a comprehensive idea on the evolution & cytogenetics of cultivated crops

Course content

Cytology

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, heterochromatin, allocyly and heteropycnosis.
5. Special type of chromosomes: Polytenic 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

Cytogenetic

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 consequences.
11. Genome and individual chromosome identification using autoradiography, microspectrophotometry, banding and in situ hybridization.
12. Cytogenetics of wheat in relation to:
 - a) Origin and distribution of the polyploid wheats and related species.
 - b) Genomic relationship of the phylogenetically related species.

need to shift in MS course

- Describe the concept of mutation and their possible implications in crops improvement
- Outline and explain the chemical organization, structural and numerical changes of chromosome
- Analyze chromosome structures and identify individual chromosomes
- Describe the evolutionary pathway of cultivated wheat

Teaching strategy: • Lecture • Assignment • Video clip • Small group discussion
Assessment strategy: • MCQ • Short question • Essay type question

References

1. Perry, J. and Appels, R. 1998. Chromosome structure and Function. Plenum press, New York and London.
2. Verma, P.S. and Agarwal, V. K. 1998. Cytology. S. Chand & Co. Ltd. Ram Nagar, New Delhi.
3. Gupta P.K. 1987. Genetics 2nd ed. Rastogi Publication Meerut, India.
4. Gupta, P.K. 1995. Cytogenetics. 1st. ed. Rastogi, India.
5. Strickberger, M.W. 1990. Genetics. 3rd ed. Macmillan Publishing Co. New York.
6. Verma, P.S. and V.K. Agarwal, 1998. Genetics. 8th ed. S. Chand and Co. Ltd. New Delhi.
7. Brown, W.V. 1972. A Text Book of Cytogenetics. C.V. Mosby Pub. , St. Loise, USA.
8. Burns, G.W. 1980. The Science of Genetics, 4th ed. Macmillan Publishing Co. Inc, New York.
9. Evan, L. T. and Peacock, W. J. 1981(ed). Wheat science- today and tomorrow. Cambridge University Press, Cambridge, London
10. Riley, H. P. 1967. Introduction to Genetics and Cytogenetics. Hafner Pub. Co. Inc. New York.

Course code	: AG 2210
Course Title	: Cytology and Cytogenetics– Lab
Course type	: Major
Number of credits	: 1
Total marks	: 100

Objectives

- Introduce basic laboratory rules on microscopy for cytological studies
- Demonstrate and identify stages of mitosis and meiosis
- Explain the effects of physical and chemical agents on chromosomal aberrations

Course content

1. Study of mitosis in onion root tip cells
2. Study of meiosis in the pollen mother cells of onion
3. Effect of colchicine treatment on onion/garlic root tip chromosome
4. Effect of gamma - ray irradiation on onion/garlic root tip chromosomes

Learning outcomes

- Prepare slides from plant samples to describe and identify different stages of mitosis and meiosis
- Examine the effect of colchicine and gamma-ray on somatic cell division

Teaching strategy: • Lectures • Demonstration of different stages of cell division
 • Demonstration of normal versus aberrations in dividing cells
 • Tutorial

Assessment strategy: • Quiz • Identification of different phases of cell divisions
 • Experiment • Assignment

References

1. Verma, P.S. and Agarwal, V. K. 1998. Cytology. S. Chand & Co. Ltd. Ram Nagar, New Delhi.
2. Perry, J. and Appels, R. 1998. Chromosome structure and Function. Plenum press, New York and London.
3. Burns, G.W. 1980. The Science of Genetics 4th ed. Macmillan publishing co. Inc. New York.
4. Sarma, A. 1991. Chromosomes. Oxford & IBH Pub. Co. New Delhi
5. Sharma A.K. and Sharma, A. 1980. Chromosomes 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 Hall of India private Ltd.
7. Cytologia - International Journal of Cytogenetics and Cell Biology. 1998.

Course code	: AG 2211
Course Title	: Fundamentals of Extension, Leadership and Motivation-Theory
Course type	: Major
Number of credits	: 3
Total marks	: 100

Objectives

- Deliver the information about the concepts of extension, extension education extension teaching methods and aids
- Acquaint the students with learning process
- Provide ideas on different extension teaching methods and their use
- Offer fundamental ideas of leadership and motivation in extension work.

Course content

Extension Education: Basic concepts of extension, education, and extension education; evolution of extension; and comparative history of agricultural extension in South-east Asia; philosophies, principles, scope and phases of extension work.

Learning process: Elements in the learning process; theories of learning; laws of learning and their implication in extension work; special features of adult learning.

Extension teaching process: Meaning and steps; guides to effective extension teaching; classification of extension teaching methods; procedures, advantages and limitations of extension teaching methods; criteria/factors for selection and use of extension teaching methods.

Teaching aids: Purpose and classification; selection of appropriate teaching aid.

Leadership: Importance in extension work, types, and qualities of a good leader; different methods for identification; ways of recognizing; methods of organizing and developing local leaders; duties and responsibilities of local and professional leaders; importance of opinion leadership in extension work; opinion leaders and their characteristics.

Fundamentals of motivation in extension: Concept of need and motivation; importance of motivation in extension work; ways of motivating extension workers and farmers.

Need theories: Concept of need; need theories of Maslow, Herzberg and McGregor; implication of need theories in extension work.

Learning outcomes

- Explain fundamental issues of extension education and extension work
- Describe the learning theories and laws of learning along with their implications in extension work
- Identify and explain extension teaching methods and aids along with their utilizations in extension work
- Justify the use of leadership skill in extension work
- Explain the issues related to motivation in extension work
- Apply need theories in extension work

Teaching strategy: • Lecture and discussion • Self study

Assessment strategy: • Written examination • Assignment • Short question

References

1. Beal, G.M., J.M. Bholen and. J.N. Roudabaugh 1972. Leadership and Dynamic Group Action. Ames: The Iowa State University Press.
2. Bhuiya, M.H. 1988. Krishi Samprasaran Parichiti, Dhaka Jamuna Printers.
3. Bhuiya, M.H. and M. A. M. Miah. 1998. Extension Psychology, Krishi Lekhak Forum, Dhaka: Colourline Printers.

4. Ray, G.L., 1991. Extension Communication and Management. 2nd edition, Naya Prokash Publication, Calcutta, India.
5. Wilson, M.C. and G. Gallup. 1955. Extension Teaching Methods. Federal Extension Service, U.S. Dept. of Agriculture.

Course code	: AG 2212
Course Title	: Fundamentals of Extension, Leadership and Motivation- Lab
Course type	: Major
Number of credits	: 1
Total marks	: 100

Objectives

- To provide information on various aspects on different extension teaching methods and aids
- To deliver instructions to prepare, present and practice the commonly used extension teaching methods and aids
- To guide the students to use group techniques in extension work

Course content

1. Demonstration: Conducting method and result demonstrations.
2. Teaching Aids: Preparation and use of poster, flash cards, leaflets and flip chart.
3. Overhead projector (OHP) and slide projector: Working principles and components of OHP and slide projectors; preparation of OHP transparencies and slides; handling of OHP and slide projectors (practice session).
4. Small group discussion techniques: Brainstorming, Role Playing, and Philips 66- procedure and practice.
5. Delivering a Talk (Lecturing): Practice of delivering a talk on an assigned topic.

Learning outcomes

- Understand the basic concepts and procedure of demonstrations
- Prepare various teaching aids and apply them during extension teaching
- Prepare a presentation in projector
- Understand group techniques and their application in extension work
- Prepare a lecture script and present it as part of practice

Teaching strategy: • Lecture • Individual presentation • Group discussion/ Group work • Group presentation • Video presentation practice

Assessment strategy: • Short question • Written • Viva

References

1. Ray, G.L. 2010. Extension Communication and Management. 5th edition, NayaProkash Publication, Calcutta, India.
2. Anonymous. 2016. Practical Manual for Agricultural Extension Education, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh.