

**COURSES RELATED TO AGRONOMY
FOR
UNDER GRADUATE AND POST GRADUATE
DEGREE PROGRAMME**

**B. Sc. (Hons.) Agriculture
B. Sc. (Hons.) Horticulture
B. Tech. in Agricultural Engineering**

M. Sc. (Ag.) in Agronomy

Ph. D. (Ag.) in Agronomy



**Department of Agronomy
Faculty of Agriculture
Bidhan Chandra Krishi Viswavidyalaya
Mohanpur, Nadia, West Bengal**

COURSES RELATED TO AGRONOMY FOR UNDER GRADUATE AND POST GRADUATE DEGREE PROGRAMME

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B. Sc. (Hons.) Agriculture

Course No.	Course Title	Credits
1st Semester		
AG 101	Agriculture Heritage	1+0
AGR 102	Fundamentals of Agronomy I	1+1
SWAG 108	Introduction to Forestry	1+1
2nd Semester		
AGR 151	Fundamentals of Agronomy II	1+1
AGR 152	Crop Production Technology I (<i>Rabi</i> crops)	1+1
3rd Semester		
AGR 201	Crop Production Technology II (<i>Kharif</i> crops)	1+1
4th Semester		
AGR 251	Crop Production Technology III (<i>Rabi</i> crops)	1+1
EC 260	Hill, Dry land and Coastal Agriculture	2+1
5th Semester		
AGR 301	Crop Production Technology IV (<i>Kharif</i> crops)	1+1
AGR 302	Rainfed Agriculture and Watershed Management	1+1
EC 312	Watershed and Wetland Management	2+1
EC 313	Weed Management	2+1
6th Semester		
AGR 351	Principles of Organic Farming	1+1
AGR 352	Farming System and Sustainable Development	1+1
AGMP 355	Geo-informatics, Nano-technology and Precision Farming	1+1

B. Sc. (Hons.) Horticulture

Course No.	Course Title	Credits
5th Semester		
AGR (H) 307	Introduction to Major Field Crops	1+1
HORT(A) 102	Water Management in Horticultural Crops	1+1
SWAG(H) 310	Introductory Agro-forestry	1+1

B. Tech. in Agricultural Engineering

Course No.	Course Title	Credits
1st Semester		
AGR (E) 111	Agriculture for Engineers	2+1

B. Sc. (Hons.) Agriculture

AG 101: Agriculture Heritage (1+0)

[1st Semester]

Theory

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

[The course is catered jointly by the Department of Agronomy and Department of Agricultural Extension.]

AGR 102: Fundamentals of Agronomy I (1+1)

[1st Semester]

Theory

Agronomy and its scope; Seeds and sowing; Crop density and geometry; Crop nutrition, manures and fertilizers, nutrient use efficiency; Growth and development of crops, factors affecting growth and development; Plant ideotypes; Crop rotation and its principles; Adaptation and distribution of crops; Agro-climatic zones of India and West Bengal. Weeds: importance, classification, crop-weed competition; Weed management: concept, principles, methods; Herbicides: classification, selectivity and resistance, allelopathy.

Practical

Identification of crops, seeds, fertilizers and tillage implements; Study of agro-climatic zones of India; Methods of fertilizers application; Study on yield contributing characters and yield estimation; Seed germination and viability test; Numerical exercises on fertilizer requirement and plant population; Identification of weeds in crop fields and study on weed seed bank; Cultural, mechanical and biological methods of eco-safe weed management; Calibration of sprayer, types of herbicides and application methods; Numerical exercise on herbicide and weed control efficiency.

SWAG 108: Introduction to Forestry (1+1)

[1st Semester]

Theory

Introduction – definitions of basic terms related to forestry; Objectives of silviculture, forest classification, salient features of Indian Forest Policies; Forest regeneration, natural regeneration– natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers, artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations; Crown classification; Tending operations – weeding, cleaning, thinning–mechanical, ordinary, crown and advance thinning; Forest mensuration–objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement–shadow and single pole method; Instrumental methods of height measurement; Geometric and trigonometric principles, instruments used in height measurement; Tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees; Agroforestry–definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens; Cultivation practices of two important fast growing tree species of the region.

Practical

Identification of tree species; Diameter measurements using calipers and tape; Diameter measurements of forked, buttressed, fluted and leaning trees; Height measurement of standing trees by shadow method, single pole method and hypsometer; Height measurement of standing trees by shadow method, single pole method and hypsometer; Volume measurement of logs using various formulae; Nursery lay out, seed sowing, vegetative propagation techniques; Forest plantations and their management; Visit to nearby forest-based industries.

[The course is catered jointly by the Department of Soil and Water Conservation and Department of Agronomy.]

AGR 151: Fundamentals of Agronomy II (1+1)

[2nd Semester]

Theory

Water resources and irrigation development in India and West Bengal; Irrigation: definition and objectives; Soil-water and plant-water relationships; Soil moisture tension, Soil water classification and constants; Crop water requirement; Effective rainfall; Water use efficiency, Evapo-transpiration; Irrigation scheduling and criteria, Surface irrigation methods, drip and sprinkler irrigation; irrigation efficiencies; Water requirement of major field crops; Quality of irrigation water; Water logging and drainage; Concept of tillage and tilling; Types of tillage and their practices, factors affecting tillage operations, Modern concept of tillage.

Practical

Study on soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Methods of moisture estimation; Measurement of irrigation water and determination of irrigation efficiency; Calculation on water requirement; Identification of different types of tools and implements Use of tillage implements and inter-cultural practices like ploughs and harrows, wheel hoe, etc.; Calculation related to tillage operations.

AGR 152: Crop Production Technology I (*Rabi* crops) (1+1)

[2nd Semester]

Theory

Origin, geographic distribution, economics importance, soil and climatic requirements, varieties, cultural practices and yield of *rabi* crops:

Cereals: Wheat and Barley

Pulses: Chickpea; Lentil, Peas, Lathyrus and French bean

Oilseeds: Rapeseed and Mustard; Sunflower and Linseed

Commercial crop: Tobacco

Practical

Field preparation, sowing of *rabi* cereals, pulses, oilseed crops and tobacco, and multiple cropping; Calculations on seed rate and fertilizers; Use of bio-fertilizers, top dressing of nutrients, identification of weeds and their control measures, important intercultural operations and water management; Morphological and yield attributing characteristics, estimation of yield, harvesting, threshing, winnowing and storage of *rabi* field crops; Cost of cultivation; Crop distribution in West Bengal and its ecological regions; Visit to research stations for related crops and multiple cropping.

AGR 201: Crop Production Technology II (*Kharif* crops) (1+1)**[3rd Semester]****Theory**

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of *kharif* crops:

Cereals: Rice, Maize, Sorghum, Pearl millet and Minor millets

Pulses: Pigeonpea, Mungbean and Urdbean

Practical

Nursery preparation, sowing and transplanting of rice; Field preparation and sowing of *kharif* cereals and pulse crops including inter / mixed cropping; Calculations on seed rate, effect of seed size and sowing depth on germination, seedling vigour of *kharif* field crops; Calculations on fertilizers, top dressing, and foliar feeding of nutrients; Identification of weeds and their control measures; Important intercultural operations and water management in *kharif* crops; Morphological and yield attributing characteristics, estimation of yield, harvesting, threshing, winnowing and storage of *kharif* field crops; Cost of cultivation; Crop distribution in West Bengal and its ecological regions; Study of crop varieties and important agronomic experiments at experimental farms; Visit to research stations for related *kharif* crops and multiple cropping.

AGR 251: Crop Production Technology III (*Rabi* crops) (1+1)**[4th Semester]****Theory**

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of *rabi* and summer crops:

Tuber crop: Potato

Oilseed crops: Sesame, Groundnut, Soybean, Safflower

Forage crops: Maize, Sorghum, Oat, Berseem, Lucerne, Cowpea, Ricebean, Napier and Clusterbean

Practical

Field preparation, sowing of *rabi* / summer tuber, oilseed and forage crops, and inter / mixed cropping; Calculations on seed rate and fertilizers, top dressing of fertilizers, identification of weeds and their control measures, important intercultural operations and water management in *rabi* / summer crops; Morphological and yield attributing characteristics, estimation of yield, harvesting, threshing, winnowing and storage of *rabi* / summer field crops; Cost of cultivation; Crop distribution in West Bengal and its ecological regions; Study of crop varieties and important agronomic experiments at experimental farms; Visit to research stations for related *rabi* / summer crops and multiple cropping.

EC 260: Hill, Dry land and Coastal Agriculture (2+1)**[4th Semester]****Theory**

Concept of hill agriculture, distribution in West Bengal, soil and climate, terrace cultivation, *jhum* cultivation, traditional farming, cropping system, agronomic management including irrigation, soil and water conservation methods; Concept of dryland agriculture, distribution in West Bengal, soil and climate, moisture stress and drought, cropping system, agronomic management including choice of crops / varieties, moisture conservation, irrigation scheduling, use of indicator plants and anti-transpirants; drought avoidance / mitigation practices, contingent crop planning; Concept of coastal agriculture, distribution in West Bengal, soil and tidal water management, cropping system, agronomic management including choice of crops / varieties, irrigation and drainage; rice-*cum*-fish culture, shelterbelts.

Practical

Sowing and management of rainfed *rabi* crops including use of mulches and anti-transpirants; Calculation on drought indices and water use efficiency; Making contour bunds against slopes; Calculation on scheduling of irrigation for different crops; Determination of quality of irrigation water; Preparation of contingent crop planning schedule for early, mid-season and terminal droughts in dryland areas, and storm-affected areas of coastal region; Visit to local rice-*cum*-fish culture farm.

AGR 301: Crop Production Technology IV (*Kharif* crops) (1+1)

[5th Semester]

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of fibre crops; commercial crops, medicinal and aromatic crops:

Fibre crops: Jute, Cotton and Sunnhemp

Commercial crops: Sugarcane and Sugarbeet

Medicinal and Aromatic: Mentha, Citronella, Lemon grass, Palmarosa, Isabgul and Poppy

Practical

Field preparation, sowing of fibre, commercial, medicinal and aromatic crops, and inter / mix cropping; Calculations of seed rate and fertilizers; Effect of seed size and sowing depth on germination and seeding vigour of fibre, commercial, medicinal and aromatic crops; Top dressing and foliar feeding of nutrients; Identification of weeds and their control measures, important intercultural operations and water management; Study of varieties, yield contributing characters, yield estimation of important fibre, commercial, medicinal and aromatic crops; Cost of cultivation; Crop distribution in West Bengal and its ecological regions; Study of crop varieties and important agronomic experiments at experimental farms; Visit to research stations for related *kharif* crops and multiple cropping.

AGR 302: Rainfed Agriculture and Watershed Management (1+1)

[5th Semester]

Theory

Rainfed agriculture: history, introduction and types; Soil and climatic conditions prevalent in rainfed areas; Drought: types, effect of water deficit on physio-morphological characteristics of the plants; Crop adaptation and mitigation to drought; Efficient utilization of water through soil and crop management practices, management of crops in rainfed areas; Contingent crop planning for aberrant weather conditions; Soil and water conservation techniques; Water harvesting: importance and its techniques; Watershed management: history, concept, objectives, principles, components, influential factors, choice of crops and cropping system.

Practical

Study on rainfall pattern in rainfed areas of the country; Study on cropping pattern of different rainfed areas; Rainfall analysis: Frequency, intensity, duration and probability; Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops; Study on cultural practices for mitigating moisture stress; Field demonstration on soil and moisture conservation measures; Characterization and delineation of model watershed; Field demonstration on construction of water harvesting structures; Analysis of case studies of some identified watersheds and their management in different agro-climatic conditions; Visit to rainfed research station / watershed

EC 312: Watershed and Wetland Management (2+1)

[5th Semester]

Theory

Delineation of watershed; Watershed Atlas of India; Selection criteria and methods of identification of watershed; Steps, procedure and planning of watershed management; Watershed hydrology, rainfall-runoff relationship; Case studies of some identified watershed and their management under different agro-climatic situation; Selection of different conservation treatment and production systems and their use in watershed management; Developing economically and ecologically sustainable agro-forestry systems for watershed; Wetlands: definition, distribution; types, classification, ecology, functions, attributes and values; Wetland rules in India; Agriculture in wetland resources: improvised methodological approaches and aquatic crops (food, food-cum-ornamental, non-food commercial, medicinal plants etc.); Wetland management for livestock production: principles and management practices, integration with fish culture and agriculture for sustainable use; Wetland management for fish culture: principles and practices of aquaculture with special reference to wetland utilization; Threats to wetlands: climate change and human use, impact of industrialization, conservation, protection, and restoration and challenges; Livelihood development and impacts of agriculture on wetlands.

Practical:

Study on watershed atlas of India; Delineation of watershed; Rainfall analysis–frequency, intensity, duration and probability; Analysis of rainfall-runoff relationship; Case studies of a few identified watersheds – their management under different agro-climatic situations; Wetland morphometry, Analysis and identification of abiotic (physico-chemical properties of water) and biotic components (aquatic plants, phytoplankton, zooplankton and benthic invertebrates) of wetlands; Study on different types of livestock production systems in wetlands; Identification of some culturable fish and prawn species; Visit different types of models for aquatic crops and integrated fish farming in wetlands

[The course is catered jointly by the Department of Soil and Water Conservation, Department of Agronomy and Department of Animal Science.]

EC 313: Weed Management (2+1)

[5th Semester]

Theory

Classification, characteristics, reproduction and dissemination of weeds; Crop-weed association / competition and weed seed bank; Harmful and beneficial effects of weeds, and their utilization; Survey and surveillance of weeds including invasive ones; Eco-safe weed management by cultural and mechanical methods; Biological methods, bio-agents, bio-herbicides and allelopathy in weed management; Status, advantages and limitations of usage of herbicides in India; Chemical weed management, herbicides: classification, selectivity, resistance, mixtures, compatibility with other agro-chemicals; Concept of formulations, and use of adjuvants, safeners and surfactants; Concept and application of integrated weed management for major field crops; Weed management for important cropping systems.

Practical

Identification of weed flora in various ecological situations and cropping systems; Study on crop-weed competition and weed seed bank; Techniques of weed preservation and preparation of weed herbarium; Study on bio-efficacy and phyto-toxicity symptoms of herbicides in different crops; Computation of herbicide doses and demonstration of application methods; Calculation on weed index and weed control efficiency; Preparation and application of bio-herbicides; Weed utilization as compost (Parthenium, Water hyacinth, Cassia, etc.)

AGR 351: Principles of Organic Farming (1+1)**[6th Semester]****Theory**

Organic farming: principles, status and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, labeling, marketing and export potential of organic products, and economic considerations and viability.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers / bio-inoculants, their quality analyses and applications; Use of green manures; Raising of high-value crops under organic production system; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; grading, packaging, handling and quality aspect.

AGR 352: Farming System and Sustainable Development (1+1)**[6th Semester]****Theory**

Farming System: scope, importance and concept; Types of farming system and influential factors; Farming system components and their maintenance; Cropping system and pattern, multiple cropping, efficient cropping system and their evaluation, allied enterprises and their importance; Tools for determining production and efficiencies in cropping and farming system; Integrated Farming System (IFS): historical background, objectives, characteristics, components and advantages, Site-specific development of IFS model for different agro-climatic zones; Resource-use-efficiency and optimization techniques, resource cycling and flow of energy in different farming system; Farming system and environment; Sustainable agriculture: concept and impact on agriculture, indicators of sustainability, adaptation and mitigation; Conservation agriculture strategies in agriculture, techniques for sustainability of HEIA, LEIA and LEISA.

Practical

Preparation of cropping scheme for irrigated and dryland situations; Preparation of integrated farming system model for wetlands and drylands; Calculations on yield advantage and efficiency of cropping and farming systems; Preparation of map showing different cropping systems for different districts / agro-climatic zones of West Bengal Visit of IFS models at University and farmers' fields in different agro-climatic zones; Study on indicators of sustainability; Cultivation practices for conservation agriculture.

AGMP 355: Geo-informatics, Nano-technology and Precision Farming (1+1) [6th Semester]**Theory**

Precision agriculture: concept, techniques, issues and concerns for Indian agriculture; STCR approach for precision agriculture; Nanotechnology: definition, concept and techniques; Nanoscale effects, nanoparticles, nano-pesticides, nano-fertilizers, nano-sensors, etc.; Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity; Geo-informatics: definition, concept, tools and techniques; their uses in precision agriculture; Crop discrimination and yield forecasting, soil mapping; fertilizer recommendation using geo-spatial technologies, spatial data and their management in GIS; Remote sensing: concept and application in agriculture and natural resource management; Basic aspects of image processing and visual image interpretation; Global positioning system (GPS): components and its functions; Crop simulation models: concept and uses for optimization of agricultural inputs.

Practical

Fertilizers recommendations based of VRT and STCR techniques; Formulation, characterization and applications of nano-particles in agriculture; Introduction to GIS software, creation and editing of spatial data, creation of thematic maps; Introduction to remote sensing/image processing software; Visual and digital interpretation of remote sensing images; Multi-spectral remote sensing for soil mapping; Monitoring of crop stress (biotic/abiotic) using geo-spatial technology; Use of GPS for agricultural survey. [The course is catered jointly by Department of Agricultural Meteorology and Physics, and Department of Agronomy.]

B. Sc. (Hons.) Horticulture

AGR (H) 307: Introduction to Major Field Crops (1+1)

[5th Semester]

Theory

Meaning and scope of Agronomy; Classification and distribution of field crops; Cultivation practices for major Cereals (Rice and Wheat), Pulses (Chickpea, Lentil, Greengram and Blackgram), Oilseeds (Rapeseed-Mustard and Groundnut), Fibre crops (Jute), Sugar crops (Sugarcane), and Green manure crops; Definitions and concepts of multiple cropping, mixed cropping, intercropping, relay cropping, alley cropping, and crop rotation.

Practical

Identification of plants and seeds of different crops and varieties; Identification of weeds in crop fields; Identification of manures, fertilizers and farm implements; Land preparation, sowing, cultivation practices and harvesting of major field crops in individual plots; Raising crops in mixed, inter and relay cropping systems; Application of manures, fertilizers and herbicides in field crops; Calculation on seed rate, fertilizer requirement and estimation of yield of major field crops; Preparation of cropping scheme including horticultural crops.

HORT (A) 102: Water Management in Horticultural Crops (1+1)

[5th Semester]

Theory

Importance of water, water resources in India. Area of different crops under irrigation, function of water for plant growth, effect of moisture stress on crop growth. Available and unavailable soil moisture – distribution of soil moisture – water budgeting – rooting characteristics – moisture extraction pattern. Water requirement of horticultural crops – lysimeter studies – plant water potential climatological approach – use of pan evaporimeter – factor for crop growth stages – critical stages of crop growth for irrigation. Irrigation scheduling – different approaches – methods of irrigation – surface and sub-surface pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops. Layout of different irrigation systems, drip, sprinkler. Layout of underground pipe-line system.

Practical

Measurement of irrigation water by using water measuring devices, use of common formula in irrigation practices, practicing of land leveling and land shaping implements, layout for different methods of irrigation. Estimation of soil moisture constants and soil moisture by using different, methods and

instruments, scheduling of irrigation, different approaches, practicing use of instruments, estimation of irrigation efficiency and water requirements of horticultural crops, irrigation planning and scheduling, soil moisture conservation practices.

[The course is catered jointly by the Department of Agronomy and Faculty of Horticulture.]

SWAG (H) 310: Introductory Agro-forestry (1+1)

[5th Semester]

Theory

Agro-forestry: definition, objectives and potential, distinction between agro-forestry and social forestry; Status of Indian forests and role in Indian farming systems; Agro-forestry system, sub-system and practice: agri-silviculture, silvipastoral, horti-silviculture, horti-silvipastoral, agri-horti-silviculture, shifting cultivation, taungya, home gardens, alley cropping, intercropping, wind breaks, shelter belts and energy plantations; Planning of agro-forestry: constraints, diagnosis and design methodology; Selection of tree crop species for agro-forestry; MPTs: nursery, planting, management practices, economics of cultivation, (Gamhar, *Acacia auriculiformis*, *Dysoxylum binectariferum*, *Anthocephalus cadamba*, *Leucaena*, *Tectona*, *Morus*, *Glyricidia sp.*, *Pongamia sp.* Eucalyptus, Bamboo, Tamarind, Neem, etc.).

Practical

Identification of seeds and seedlings of multipurpose tree species; Nursery practices for Gamhar, *Acacia auriculiformis*, *Anthocephalus cadamba*, *Leucaena*, *Tectona*, *Morus*, Eucalyptus, Bamboo, Neem, etc.; Measurement of diameter at breast height, height of trees, volume of logs / trees, etc.; Visit to agro-forestry field to study the compatibility of MPTs with agricultural crops: silvi-pastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks; Visit to social forestry plantations: railway-line plantations, canal plantations, roadside plantations, industrial plantations, wind breaks and shelter belts; Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages; Economics and marketing of products raised in agro-forestry systems.

[The course is catered jointly by the Department of Soil and Water Conservation, and Department of Agronomy.]

B. Tech. in Agricultural Engineering

AGR (E) 111: Agriculture for Engineers (2+1)

[1st Semester]

Theory

Introduction and scope of Agronomy; Classification of crops; Crop seasons; Weather parameters and their effects on crop growth and yield; Principles of tillage, tilth and its characteristics; Methods, time and depth of sowing / planting of major field crops; Methods of intercultural operation; Methods and time of application of manures and fertilizers; Soil-water-plant relationship; Crop coefficient; Water requirements of crops and critical stages for irrigation; Weeds and their control; Crop rotation, cropping systems, intercropping, mixed cropping and relay cropping; Organic farming; Sustainable agriculture.

Practical

Identification of seeds and plants of different crops and varieties; Identification of weeds, manures-fertilizers and small farm implements; Practice of ploughing and puddling; Practice of sowing / planting; Fertilizer application methods; Weed control methods; Irrigation methods, and determination on water flow measurements and water use efficiency; Calculation on seed rate, fertilizer requirement and estimation of yield of different field crops.