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 FORUNDER GRADUATE AND POST GRADUATEDEGREE PROGRAMME

First Edition: April, 2019

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Published by: Department of Agronomy,
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal.

Ph.D. (Ag.) in Agronomy

Course No.	Course Title	Credit(s)
1st Semester		
AGRON 701	Research Methodology in Agronomy	2+1
AGRON 702	Current Trends in Agronomy	2+0
AGRON 703	Crop Ecology	2+0
AGRON 704	Advances in Crop Growth and Productivity	2+1
2nd Semester		
AGRON 751	Integrated Farming Systems	2+1
AGRON 752	Advances in Weed Management	2+1
AGRON 753	Advances in Water Management	2+1
AGRON 754	Crop Production under Stress	2+0
AGRON 799	Seminar I (Doctoral Plan of Reseaech)	1+0
3rd Semester		
AGRON 801	Conservation Agriculture in Crop Production	2+1
AGRON 802	Crop Production in Wetland Eco-system	2+1
4th Semester		
AGRON 899	Seminar II (Doctoral Seminar)	1+0
5thSemester		
6th Semester		
AGRON 999	Seminar III (Doctoral Research)	1+0

AGRON 701: Research Methodology in Agronomy (2+1) [1st Semester]

Theory

Unit I: Plan of work and objectives of study; Experimental design, treatments and replications; Layout of field experiment; Statistical analysis, ANOVA, calculation of critical differences, correlation and regressions; Interpretation of results; Ethics of Agronomist in research;

Unit II: Methodology of recording germination behaviour, seedling vigour and growth parameters and determination of indices (LAI, CGR, NAR, RGR, etc.) of field crops; Estimation of yield and harvest index; Assessment of quality parameters of crops: milling, nutritional, cooking, etc.; Economics of cultivation; Energy requirement in crop production;

Unit III: Methodology for determination of weed diversity in crop field, crop-weed competition and weed control efficiency; Irrigation requirement, water use and water balance in soil; Nutrient uptake pattern, residual fertility status and fertilizer use efficiency; Types of thermal indices and their correlations with growth and economic yields; Methodology for evaluation of yield, economic and land use advantages in various cropping and farming systems.

Practical

Making layout of different types of field experiments; Field observation and use of instruments (leaf area meter, leaf colour chart / line quantum sensor, etc.); Calculation on growth attributes, yield and economics of field crops; Study on phenophases and calculation of thermal indices (GDD, HTU, PTU, etc.) of important field crops; Determination of quality parameters of different crops; Calculation on nutrient use efficiency and preparation of nutrient balance sheet; Calculation on weed control efficiency, water use efficiency and energy requirement of different cultivation systems; Calculation on yield advantage, land use and related indices of cropping and farming systems; Analysis of research data and interpretation of findings including figures; Making abstracts based on research findings of different field experiments; Making year-wise list of doctoral theses on Agronomy available in Department/ Central Library including a study on various experimental designs; Visit to Central Library for collection of references from journals, theses and e-systems.

AGRON 702: Current Trends in Agronomy (2+0) [1st Semester]

Theory

Unit I: Globalization of agriculture and WTO, precision agriculture, contract farming, organic farming and green agriculture;
Unit II: Concept of hybrid seed production; Genetically modified (GM) crops: uses and limitations; Latest developments in land and crop management; Eco-safe and economic uses of fertilizer-manures, water and herbicides;
Unit III: GIS, GPS and remote sensing for crop management, agro-advisory services and crop insurance; Global warming; Climate change and strategies for agronomic management;
Unit IV: Concept of system agriculture; Holistic approach of farming systems; Mechanization of agro-techniques in varied farm sizes; Vertical farming, hydrophonics and aerophonics; Sustainable agriculture.

AGRON 703: Crop Ecology (2+0) [1st Semester]

Theory

Unit I: Concept of crop ecology; Eco-system: kinds and general characteristics; Diversity in agricultural system; Geographic distribution of crops plants and their adaptation;
Unit II: Ecosystem: characteristics, types, structure and functions, Terrestrial ecology, flow of energy, food chain and food web; Ecosystem productivity, biomass, succession and climax concept; Qualities of agro-ecosystems;
Unit III: Physiological response of crop plants to light, temperature, CO_2, moisture and solar radiation; Influence of climate on photosynthesis and productivity of crops; Effect of global climate change on crop production; Geographical change due to climate change;
Unit IV: Vertical temperature profile of the atmosphere; Climatic requirements of important field crops; Environmental pollution and crop responses; Region-based strategic activities; Improvement of unproductive lands through crop selection and management.

AGRON 704: Advances in Crop Growth and Productivity (2+1) [1st Semester]

Theory

Unit I: Germination and vigour index with relation to agronomic management; Crop phenology, determinate and indeterminate types of growth, stages of crop growth; Heat units: concept, types and their relationships with crop phenology and maturity; Plant and environmental factors affecting crop growth and development; Physiological limitations to crop yield; Effect of abiotic stress on crop growth and productivity;

Unit II: Growth analysis: concept, indices like CGR, RGR, NAR, LAI, LAD, LAR, etc.; Validity and limitations in interpreting crop growth and development; Growth curves: sigmoid, polynomial and asymptotic; Root systems and root-shoot relationships; Leaf area and solar radiation interception; Translocation of photosynthates to grain and source-sink relationship; Yield gap analysis; Lodging behaviour of crops;
Unit III: Competitive relationship and competition functions; Inter and mixed cropping systems under rainfed and irrigated conditions; Criteria in assessing the yield advantages; Physiological aspects in dry land crop production and remedial measures;
Unit IV: Concept of plant ideotypes; Characteristics of ideotype for wheat, rice, maize, etc.

Practical

Study on germination, seedling length and vigour index of different crops; Estimation of growth evaluating parameters (LAI, CGR, RGR, NAR, etc.) and light interception at different stages of crop; Making of crop growth curves based on growth analysis data; Study on plant height, tillering pattern, branching habit, flower initiation, pod and seed formation of different crops in fields; Determination of chlorophyll content in leaves of major field crops; Measurement on root and shoot parameters and their relationships; Scoring of lodging and determination of physiological matuity of crops; Assessment of crop yield and computation of harvest index of various crops; Calculation of heat units (GDD, HTU, PTU, etc.) of different crops and determination of heat use efficiency (HUE); Computation of competition functions (LER, ATER, aggressivity, etc.) and yield advantages in intercropping systems; Analysis of productivity trend in rainfed and irrigated areas.

AGRON 751: Integrated Farming Systems (2+1) [2nd Semester]

Theory

Unit I: Integrated farming system: definition, importance and classification; Enterprises and their relationships; Crop diversification and rotation, cropping system and production economics; Production potential of different components in farming systems; Degree of commercialization;

Unit II: Concept of sustainability in farming systems; Natural resources: identification and management; Efficient farming systems;
Unit III: Integrated farming systems for different agro-climatic zones in India; Farming system models for different agro-ecosystems; Economics of integrated farming systems;
Unit IV: New concepts and approaches of farming systems; Enterprise-based farming system, on-farm processing and value-addition; Organic farming system; Simulation models for cropping and farming system; Farming system research and case studies.

Practical

Making schematic diagram of various components of farming systems including land use and production potentials; Study on resource recycling with productivity and profitability linkages in different integrated farming systems and making flow-charts; Evaluation of farming systems in respect of economics and employment generation; Study on farming system models and analysis of sustainability; Calculation on farming system indices (diversity index, etc.); Preparation of a Term Paper on a specific farming system model; Development of different steps of farming system research design in a locality; Visit to farming system research plots in the farm/ research station; Visit to farm family in a nearby village and making a report on small-farm system including enterprises, interrelationships and economics; Visit to integrated or organic farms in the district/ region.

AGRON 752: Advances in Weed Management (2+1) [2nd Semester]

Theory

Unit I: Crop-weed competition in different cropping situations; Changes in weed flora, various causes and effects;
Unit II: Manual, mechanical and biological control of weeds with special reference to organic farming; Annual planning of weed management Weed management and soil microbes; Bio-herbicides: types, preparation, application and efficiency; Nano-herbicides: concept, type, application and efficiency;
Unit III: Physiological and biological aspects of herbicides, their absorption, translocation, metabolism and mode of action; Selectivity of herbicides and factors affecting them;
Unit IV: Climatic factors and phytotoxicity of herbicides; Fate of herbicides in soil and factors affecting them, residue management of herbicides; Adjuvants; Alleochemical herbicide bioassays;
Unit V: Advances in herbicide application techniques; herbicide resistance; Antidotes and crop protection compatibility of herbicides of different groups; Compatibility of herbicides with other pesticides; Relationship of herbicides with tillage, fertilizer and irrigation;
Unit VI: Development of transgenic herbicide resistant crops; Herbicide development and registration procedures.

Practical

Study on weed flora composition in terrestrial and wetland eco-system; Field study on critical crop-weed competition in different crop fields; Field study on different types of mechanical weed control methods; Making annual plan and learning integrated weed management practices in a specific crop field; Preparation and application of raw and aqueous bio-herbicides; Methods of herbigation and advantages in dry farming; Weed utilization: compost making, etc.; Study on herbicide residues in soil and herbicide resistance; Calculations for application of different forms of herbicides; Calculation on weed control efficiency and economics; Making a list of weed-related journals including publishing authority and ranking; Visit to field experiments to study various weed management practices in different crops / cropping systems; Visit to nearby village to study the adoption status and constraints of recommended weed management practices in different field crops.

AGRON 753: Advances in Water Management (2+1) [2nd Semester]

Theory

Unit I: Water resources of India; Irrigation legislation; Irrigation projects; Irrigation needs: atmospheric, soil, agronomic, plant and water factors; Water deficits and crop growth;
Unit II: Soil-plant-water relationships; Transpiration, evapotranspiration, infiltration; Water movement under saturated and unsaturated conditions; Physiological processes and crop productivity;
Unit III: Application of irrigation water, conveyance and distribution system, irrigation efficiency; Climatological factors for scheduling irrigation; Management practices for improving water use efficiency of crops; Quality of irrigation water; Agronomic considerations in the design and operation of irrigation projects; Characteristics of irrigation and farming systems affecting irrigation management;
Unit IV: Strategies of using limited water supply, control of ET by mulching and use of anti-transpirants; Fertilizer use microbial activity in relation to irrigation management; Optimizing the use of given irrigation supplies;
Unit V: Land suitability for irrigation, land irrigability classification; Integrated water management and farmer's participation in command areas;
Unit VI: Excess of soil water, drainage requirement of crops and methods of field drainage; Problem of tidal water and strategies.

Practical

Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus; Water flow measurement using different devices; Study on water infiltration characteristics and water holding capacity of soil profiles; Study on moisture extraction pattern of crops under rainfed and irrigated conditions; Estimation of consumptive use and water requirement under mono and multiple cropping sequences; Field study on irrigation methods including drip, sprinkler, etc., fertigation and drainage facilities; Calculation on irrigation requirement, water use efficiency and economics of water management; Year-round crop planning based on water availability and sustainable ecology; Agronomic evaluation of irrigation projects and case studies; Visit to field experiments on various water management practices of different crops in farm and research station; Visit to nearby villages to study irrigation methods, related constraints and ecological effects.

AGRON 754: Crop Production under Stress (2+0) [2nd Semester]

Theory

Unit I: Stress and strain terminology; Nature and stress injury and resistance; Causes of stress;
Unit II: Low temperature stress: freezing injury and resistance in plants, measurement of freezing tolerance, chilling injury and resistance in plants, practical ways to overcome the effect of low temperature stress through soil and crop manipulations;
Unit III: High temperature or heat stress: meaning of heat stress, heat injury and resistance in plants, practical ways to overcome the effect of heat stress through soil and crop manipulations;
Unit IV: Water deficit stress: meaning of plant water deficient stress and its effect on growth and development, water deficit injury and resistance, practical ways to overcome effect of water deficit stress through soil and crop, manipulations;
Unit V: Excess water or flooding stress: meaning of excess water stress, its kinds and effects on crop plants, excess water stress injury and resistance, practical ways to overcome excess water stress through soil and crop manipulations;
Unit VI: Salt stress: meaning of salt stress and its effect on crop growth, salt stress injury and resistance in plants, practical ways to overcome the effect of salt stress through soil and crop manipulations;
Unit VII: Mechanical impedance of soil and its impact on plant growth; measures to overcome soil mechanical impedance;
Unit VIII: Environmental pollution: air, soil and water pollution, and their effect on crop growth and quality of produce; ways and means to prevent environmental pollution.

AGRON 799: Seminar I (Doctoral Plan of Research) (1+0) [2nd Semester]

AGRON 801: Conservation Agriculture in Crop Production (2+1) [3rd Semester]

Theory

Unit I: Conservation Agriculture: need, status principles, benefits, prospects, differences with modern agriculture; Resource conservation technologies (RCTs) and environmental impacts;
Unit II: Soil and water conservation: nutrient mining and soil carbon loss; Role of conservation tillage, mulches, crop residues in sustaining land productivity; Water conservation practices and enhancement of water productivity;
Unit III: Weed and nutrient management in conservation agriculture: dynamics of weed population and control practices; Organic farming; Integration of nutrient management and soil health, managing soil biological systems;
Unit IV: Energy use in different farm operations (tillage, sowing/ planting, interculture, harvesting and

threshing); Energy balance in conservation agriculture and conventional farming;
Unit V: Resource-saving equipments for conservation agriculture leading to higher productivity and profitability; Resource conservation measures and energy effective equipments;
Unit VI: Mitigating climate change through conservation agriculture including no till, rotations, balanced fertilizers, bio-gas, bio-fuels, etc.

Practical

Maintenance of conservation field and work on minimal tillage, other resource conservation technologies in specific area of the farm; Making a list of traditional and modern equipments required for conservation agriculture in different situations; Seed calibration of zero-till machine; Nutrient balance estimations in crop residue management technologies; Estimation of water productivity of principal crops under conservation agriculture; Study on soil hydro-physiological property changes in conservation agriculture; Economics of conservation agriculture *vs.* traditional agriculture; Energy estimation in field operations for important crops; Collection of references / information and writing a scientific article on a specific topic of conservation agriculture.

AGRON 802: Crop Production in Wetland Eco-system (2+1) [3rd Semester]

Theory

Unit I: Wetlands: general characteristics (situation, soil, climate, cropping system, adoption pattern etc.) in West Bengal and India; *Tal* and *Diara* lands: situation of sub-zones, constraints and management;
Unit II: Soil and water characteristics (physical, chemical and bio-chemical environment) in wetlands; Wetland value and its functions; Wetlands: a source of biomass; Problems and sustainable agricultural development of wetlands; Water balance and hydrograph;
Unit III: Utilization of wetlands through cultivation of food and non-food crops (deep-water paddy, paddy-*cum*-fish culture, water chestnut, makhana, mat-sedges); Contingent crop planning in wetland ecosystem;
Unit IV: 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;
Unit V: 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

Schematic diagram of aqua-terrestrial ecosystem; Schematic diagram of global water cycle; Classification and distribution of wetland ecosystem (flow or pai chart); Study on agronomic management of wetland crops including harvesting; Study on growth parameters and estimation of yield of wetland crops; Identification of biotic components (aquatic plants, phytoplankton, zooplankton and benthic invertebrates) of wetlands; Analysis of physico-chemical properties of water; Identification and importance of wetland crops and value-added products; Economics of production of major aquatic crops under wetland situation; Study on year-round hydrological situation of wetlands in a nearby village; Field visits for wetland situation, crops and farmers' interaction.

AGRON 899: Seminar II (Doctoral Seminar) (1+0) [4th Semester]

AGRON 999: Seminar III (Doctoral Research) (1+0) [6th Semester]