



Integral University, Lucknow
Integral Institute of Agricultural Science and Technology
Evaluation Scheme of Undergraduate program
w.e.f. Session 2020-21

B. Sc. (Hons.) Agriculture

Semester – VI

Course Code	Course Title	Periods Per h/week/sem			Evaluation Scheme Theory Mid sem			Evaluation Scheme Practical Examination					End sem Theory Exam	Subject total	Credit	Total Credit Points	Attributes							
		L	T	P	CT	TA	Total	Sessional			End sem exam	Sub Total (sessional + exam)					Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
								CT	TA	Total														Total
AG335	Rainfed Agriculture & Watershed Management	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√		√		√			
AG336	Farming System & Sustainable Agriculture	1	0	0	10	10	20	-	-	-	-	20	80	100	1:0:0	1	√		√		√			
HT327	Protected Cultivation and Secondary Agriculture	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√		√		√			
AG339	Diseases of Field and Horticultural Crops and their Management-II	2	0	2	10	10	20	5	5	10	20	50	50	100	2:0:1	3	√		√		√			
HT328	Post-harvest Management and Value Addition of Fruits and Vegetables	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√		√		√			
AG340	Management of Beneficial Insects	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√		√		√			
AG341	Crop Improvement-II (Rabi crops)	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√		√		√			
AG342	Practical Crop Production –II (Rabi crops)	0	0	4	10	10	20	5	5	10	20	50	50	100	0:0:2	2	√		√		√			
AG343	Principles of Organic Farming	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√	√	√		√			
AG344	Farm Management, Production & Resource Economics	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2	√	√	√					
AG345	Principles of Food Science and Nutrition	2	0	0	10	10	20	-	-	-	-	20	80	100	2:0:0	2	√		√					
AG348	Food Safety and Standards	2	0	2	10	10	20	5	5	10	20	50	50	100	2:0:1	3*	√		√		√			
AG349	Biopesticides and Biofertilizers	2	0	2	10	10	20	5	5	10	20	50	50	100	2:0:1	3*	√		√		√			
HT330	Protected Cultivation	2	0	2	10	10	20	5	5	10	20	50	50	100	2:0:1	3*	√		√		√			
AG351	System Simulation and Agro-advisory	2	0	2	10	10	20	5	5	10	20	50	50	100	2:0:1	3*	√		√		√			
	Total															22+3*=25								

*Students can opt any one paper from the elective courses

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Rainfed Agriculture & Watershed Management
Course Code: AG335
w.e.f. Session 2020-21

Theory

2 (1+1)

Unit-1

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India

Unit-2

Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio-morphological characteristics of the plants, Crop adaptation and mitigation to drought

Unit-3

Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas,

Unit-4

Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Suggesting Readings:

Johan Rockström, K. L. Sahrawat, and Suhas Pralhad Wani (2011) Integrated Watershed Management in Rainfed Agriculture.

Suraj Nagar (2011), Integrated Watershed Management in Rainfed Agriculture.

R.K.Nanwal (2019) Rainfed Agriculture and Watershed Management.

Suhas Pralhad Wani (2009) Rainfed Agriculture: Unlocking the Potential

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Farming System & Sustainable Agriculture
Course Code: AG336
w.e.f. Session 2020-21

Theory

1(1+0)

Unit 1

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation

Unit 2

Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability

Unit 3

Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques

Unit 4

Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

Suggesting Readings:

- William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.
- A.K.Dahama. 2007. *Organic farming for sustainable agriculture*. Agrobios (India), Jodhpur
- Arnon L. 1972. Crop Production in Dry Regions. Leonard Hill Publishing Co. London.
- Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur
- Gupta O P. 1984. Scientific Weed Management in the Tropics and Sub- Tropics. Today and Tomorrow's Printers and Publishers. New Delhi.
- Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers Ludhiana.

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Protected Cultivation and Secondary Agriculture
Course Code: HT327
w.e.f. Session 2020-21

Theory **2 (1+1)**

Unit 1

Green house technology: Introduction, Plant response to Greenhouse environment, Types of Green Houses; Planning and design of greenhouses

Unit 2

Design criteria of green house for cooling and heating purposes, Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying,

Unit 3

Green house equipment's, materials of construction for traditional and low cost green houses, Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

Unit 4

Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant.

Suggesting Readings:

- Protected cultivation of Horticultural Crops by Dinesh Kumar Singh and K V Peter, NIPA Publishers
- Advances in Protected Cultivation by Bhrama Singh, by NIPA Publishers
- Hydroponics and Protected Cultivation by Lynette Morgan by CABI Publishers
- Balraj Singh. 2006. *Protected cultivation of vegetable crops*. Kalyani Publishers, Ludhiana
- Jitendra Singh, 2015. *Precision Farming in Horticulture*. New India Publishing Agency. New Delhi.

B. Sc. (Hons.) Agriculture

SEMESTER-VI

Course Title: Diseases of Field and Horticultural Crops and their Management-II

Course Code: AG339

w.e.f. Session 2020-21

Theory

3 (2+1)

Unit 1

Symptoms, etiology, disease cycle and management of Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Lentil: rust and wilt; Pea: downy mildew, powdery mildew and rust; Gram: wilt, grey mould and Ascochyta blight;

Unit 2

Symptoms, etiology, disease cycle and management of Field Crops: Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Cotton: anthracnose, vascular wilt, and black arm; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng

Unit 3

Symptoms, etiology, disease cycle and management of Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall

Unit 4

Symptoms, etiology, disease cycle and management of Horticultural Crops: Peach: leaf curl. Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Suggested Readings:

- Joshi LM, Singh DV & Srivastava KD. 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi.
- Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed.. Prentice Hall of India, New Delhi.
- Ricanel C, Egan BT, Gillaspie Jr AG & Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.
- Singh RS. 1998. Plant Diseases. 7th Ed. Oxford & IBH, New Delhi.
- Singh US, Mukhopadhyay AN, Kumar J & Chaube HS. 1992. Plant Diseases of International Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey

**B. Sc. (Hons.) Agriculture
SEMESTER-VI**

Course Title: Post-harvest Management and Value Addition of Fruits and Vegetables

Course Code: HT328

w.e.f. Session 2020-21

Theory

2 (1+1)

Unit-1

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses.

Unit-2

Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept.

Unit-3

Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards.

Unit-4

Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products.

Practical

Applications of different types of packaging, containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Suggested Readings:

- Ahmad, M.S. & Siddiqui, M.W. 2015. Post Harvest Quality Assurance of Fruits. Springer International Publishing AG Switzerland
- Nanda, V. & Sharma, S. 2017. Novel Food Processing Technologies. New India Publishing Agency.
- Bhutani RC. 2003. Fruit and Vegetable Preservation. Biotech Books.
- Chadha KL & Pareek OP. (Eds.). 1996 Advances in Horticulture. Vol. IV. Malhotra Publ. House.
- Haid NF & Salunkhe SK. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publ.
- Mitra SK. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI.
- Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Management of Beneficial Insects
Course Code: AG340
w.e.f. Session 2020-21

Theory

2 (1+1)

Unit 1

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit 2

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Unit 3

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

Unit 4

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Suggested Readings:

- Handbook of Entomology by T V Prasad 2016. Kindle Edition.
- Elements of Economic Entomology 8th Edition (English, Paperback, BV David, VV Ramamurthy
- Get latest entomology books online through:<https://www.questia.com/library/science-and-technology/life-sciences-and-agriculture/entomology>
- Get the course outlook at <http://www.jnkvv.org/PDF/0304202020410434200120.pdf>

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Crop Improvement-II (*Rabi crops*)
Course Code: AG341
w.e.f. Session 2020-21

Theory

2 (1+1)

Unit 1

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops

Unit 2

Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters

Unit 3

Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)

Unit 4

Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

Suggested Readings:

- Plant Breeding, Principles and Methods by B D Singh, Kalyani Publication.
- Vegetable Breeding, Principles and Practices by Hari Har Ram, Kalyani Publication.
- Essentials of Plant Breeding, by Phundan Singh, Kalyani Publication.
- Modern Techniques of Raising Field Crops by Chhidda Singh, Prem Singh and Rajbir Singh, Oxford and IBH Publishing Co Pvt Ltd.

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Practical Crop Production –II (*Rabi* crops)
Course Code: AG342
w.e.f. Session 2020-21

Practical

2 (0+2)

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Principles of Organic Farming
Course Code: AG343
w.e.f. Session 2020-21

Theory

2 (1+1)

Unit 1

Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture

Unit 2

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

Unit 3

Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP

Unit 4

Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

Suggested Readings:

- Principles of Organic Farming by P L Maliwa
- Principles of Organic Farming, by S R Reddy, Kalyami Publications, New Delhi
- Basics of Organic Farming by Bansal M
- Jaivik Kheti (Organic Farming) by Chandra Prakash Shukl, Pointer Publishers

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Farm Management, Production & Resource Economics
Course Code: AG344
w.e.f. Session 2020-21

Theory

2 (1+1)

Unit 1

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage.

Unit 2

Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.

Unit 3

Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation.

Unit 4

Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

Suggested Readings:

- Tandan R.K. and Dhondiyal, S.P. “Principles and Methods of Farm Management”.
- Johl, S.S. and Kapoor, T.R. “Fundamental of Farm Business Management, KalyaniPublishers,Ludhiana and New Delhi.
- Sankhayan, P.L. “Introduction to the Economics of Agricultural Production”.
- Karam, A.S. and Karan Singh “Economics of Farm Management in India”.

B. Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Principles of Food Science and Nutrition
Course Code: AG345
w.e.f. Session 2020-21

Theory

2 (2+0)

Unit 1

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions).

Unit 2

Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.).

Unit 3

Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

Suggested Readings

- Swaminathan MS Food Science, Chemistry and Experimental Foods, Bangalore Print & Publishing Company.
- Manay SN and Shadaksharaswamy M (2008): Foods: facts and principles, 3rd Ed. New Age International (P) Ltd
- Sohi D. A Comprehensive Textbook of Nutrition & Therapeutic Diets, New Delhi: Jaypee Brothers Medical Publishers
- Hughes O and Bennion, M (1970): Introductory Foods, 5th Ed. Macmillan & Co., New York
- Frazier WC and Westhoff D C and Vanitha NM (2017): Food Microbiology, 5th Ed. McGraw Hill Education.
- Jay JM (2005): Modern Food Microbiology, 3rd Ed. CBS Publishers & Distributors.

B.Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Food Safety and Standards
Course Code: AG348
w.e.f. Session 2020-21

Theory

3(2+1)

Unit 1.

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control.

Unit 2.

Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene.

Unit 3.

Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.

Unit 4.

Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

Suggested Readings:

- Carol E, Mellin; D. and Barbara A C. (1995). Food safety , food fesearch Institute, University of Wisconsin- Madison. Marcel Dekker Inc. New York
- The Food Safety and Standards Act along with Rules & Regulations. Commercial Law Publishers (India) Pvt. Ltd.
- Swaminathan M. 2005. *Handbook of Foods and Nutrition*. Ganesh and Co. Pvt. Ltd.
- Swaminathan M. 1990. *Food Science, Chemistry and Experimental Foods*. BAPPC
- Ronald H. Schmidt and Gary E. Rodrick. 2003. Food Safety Handbook. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.

B.Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Biopesticides & Biofertilizers
Course Code: AG349
w.e.f. Session 2020-21

Theory

3(2+1)

Unit 1.

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales.

Unit 2.

Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

Unit 3.

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza.

Unit 4.

Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

Practical

Isolation and purification of important biopesticides: *Trichoderma*, *Pseudomonas*, *Bacillus*, *Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Suggested Readings:

- Singh and Purohit, 2008. *Biofertilizer Technology*, Agrobios
- Shalini Suri, *Biofertilizers and Biopesticides*, 2011. APH Publishing Corporation
- Handbook of Biofertilizers and Biopesticides by Rajaram Choyal
- Recent Advances in Biopesticides by Jayandra Kumar Johnri
- Biopesticides Handbook by Jeo M.L. Nollet and Hamir Singh Rathore
- Opendar Koul, G. S. Dhaliwal and S. S. Marwaha. Biopesticide and pest management Fryer. Insect pest of fruit crops

B.Sc. (Hons.) Agriculture
SEMESTER-VI
Course Title: Protected Cultivation
Course Code: HT330
w.e.f. Session 2020-21

Theory

3(2+1)

Unit 1.

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/poly house. Greenhouse design, environment control, artificial lights, Automation.

Unit 2.

Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.

Unit 3.

Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliun, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.

Unit 4.

Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

Suggested Readings:

- Balraj Singh. 2006. *Protected cultivation of vegetable crops*. Kalyani Publishers, Ludhiana.
- Brahma Singh, 2014. *Advances in Protected Cultivation*. New India Publishing Agency. New Delhi.
- Reddy P. Parvatha, 2003. *Protected Cultivation*. Springer Publications. USA.
- Reddy, P. Parvatha. 2011. *Sustainable crop protection under Protected Cultivation*. Springer Publications, USA.
- Jitendra Singh, 2015. *Precision Farming in Horticulture*. New India Publishing Agency. New Delhi.
- Prasad S. 2005. *Greenhouse Management for Horticultural Crops*. Agrobios. Jodhpur.

B.Sc. (Hons.) Agriculture
Course Title: System Simulation and Agro-advisory
Course Code: AG351
w.e.f. Session 2020-21

Theory

3 (2+1)

Unit 1.

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams.

Unit 2.

Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production-concept and modeling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Unit 3.

Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro-advisory.

Suggested Readings:

- Pushpa Singh and Narendra Singh. 2012. Modeling and Simulation. S K Kataria and Sons
- Gurvinder Singh, Rachhpal Singh & Saluja KK. 2003. Fundamentals of Computer Programming and Information Technology. Kalyani Publishers.
- Kumar A 2015. Computer Basics with Office Automation. IK International Publishing House Pvt Ltd.
- Maidasani D. 2016. Learning Computer Fundamentals, MS Office and Internet & Web Technology. 3rd edition, Laxmi Publications.