

**Integral University, Lucknow**  
**Integral Institute of Agricultural Science and Technology**  
**Evaluation Scheme of Undergraduate program**  
**B. Sc. (Hons.) Agriculture**  
**w.e.f. Session 2019-20**

**Semester - IV**

Course Code	Subject	Periods Per h/week/sem			Evaluation Scheme Theory Mid sem			Evaluation Scheme Practical Examination					End sem Theory Exam	Subject total	Credit	Total Credit Points
		L	T	P	CT	TA	Total	Sessional			End sem exam	Sub Total (sessional + exam)				
								CT	TA	Total						
AG221	Crop Production Technology–II ( <i>Rabi Crops</i> )	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2
HT227	Production Technology for Ornamental Crops, MAP and Landscaping	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2
AE275	Renewable Energy and Green Technology	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2
AG222	Problematic Soils and their Management	2	0	0	10	10	20	-	-	-	-	-	80	100	2:0:0	2
HT228	Production Technology for Fruit and Plantation Crops	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2
AG223	Principles of Seed Technology	1	0	4	10	10	20	5	5	10	20	50	50	100	1:0:2	3
MT223	Statistical Methods	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2
BM272	Agricultural Marketing Trade & Prices	2	0	2	10	10	20	5	5	10	20	50	50	100	2:0:1	3
AG224	Introductory Agro-meteorology & Climate Change	1	0	2	10	10	20	5	5	10	20	50	50	100	1:0:1	2
	<b>Elective Course</b>													100		3*
	<b>Total</b>	<b>12</b>		<b>22</b>										<b>100</b>		<b>20+3*=23</b>

\*Students can opt any one paper from the elective courses.

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Crop Production Technology-II (Rabi crops)**  
**Paper Code: AG221**  
**w.e.f. Session 2019-20**

**Theory**

**2(1+1)**

**Unit 1.**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley,

**Unit 2.**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Pulses-chickpea, lentil, peas,

**Unit 3.**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of oilseeds-rapeseed, mustard and sunflower;

**Unit 4.**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

**Practical**

Sowing methods of wheat and sugarcane, identification of weeds in *rabi* season crops, study of morphological characteristics of *rabi* crops, study of yield contributing characters of *rabi* season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

**Suggested Readings:**

- Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers Ludhiana
- Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur
- Acquaah G. 2005. *Principles of Crop Production: Theory, Techniques and Technology*. Prentice Hall.
- Balasubrananiyan P & Palaniappan SP. 2010. *Principles and Practices of Agronomy*. Agrobios.
- Reddy SR. 2011. *Principles of Agronomy*. Kalyani Publishers

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

**Syllabus: Production Technology for Ornamental Crops, MAPs and Landscaping**

**Paper Code: HT227**

**w.e.f. Session 2019-20**

**Theory**

**2(1+1)**

**Unit 1.**

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.

**Unit 2.**

Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.

**Unit 3.**

Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol

**Unit 4.**

Production technology of important aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

**Practical**

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

**Suggested Readings:**

- Arora JS. 2013. *Introductory Ornamental Horticulture*. Kalyani Publishers.
- Bal JS. 2013. *Fruit Growing*. Kalyani Publishers.
- Chadha KL. 2012. *Handbook of Horticulture*. ICAR
- Dhaliwal MS. 2014. *Handbook of Vegetable Crops*. Kalyani Publishers
- Battacharjee, S. K. and De, L. C. 2005. *Post Harvest Technology of Flowers and Ornamentals Plants*. Ponteer Publisher, Jaipur, India.
- Kitinoja, L. and Kader, A. A. 2003. *Small-Scale Postharvest Handling practice: A Manual for Horticulture crops* (4 ed). US Davis, PHT Research and information Center.

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Renewable Energy and Green Technology**  
**Paper Code: AE275**  
**w.e.f. Session 2019-20**

**Theory**

**2(1+1)**

**Unit 1.**

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application,

**Unit 2.**

Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and bio-oil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application,

**Unit 3.**

Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

**Practical**

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

**Suggested Readings:**

- Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
- Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
- Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.
- Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.
- Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
- Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Problematic Soils and their Management**  
**Paper Code: AG222**  
**w.e.f. Session 2019-20**

**Theory**

**2(2+0)**

**Unit 1.**

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties.

**Unit 2.**

Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture.

**Unit 3.**

Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems

**Suggested Readings:**

- Soil Analysis Testing: Steps For Getting Your Soil Tested Kindle Edition, By Annie Wilkinson
- *Fundamentals of Soil Science* Indian Society of Soil Science. 1998. IARI, New Delhi
- Hillel D. 1982. *Introduction to Soil Physics*. Academic Press, London
- Brady Nyle C and Ray R Well, 2014. *Nature and properties of soils*. Pearson Education Inc., New Delhi
- Das DK. 2011. *Introductory Soil Science*. Third Revised Edition, Kalyani Publishers.
- Open Access Books - Soil Science | InTechOpen  
<https://www.intechopen.com/books/subject/soil-science/books/all/1/list>

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Production Technology for Fruit and Plantation Crops**  
**Paper Code: HT228**  
**w.e.f. Session 2019-20**

**Theory** **2(1+1)**

**Unit 1.**

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks

**Unit 2.**

Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond

**Unit 3.**

Production technologies for the cultivation of minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber

**Practical**

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

**Suggested Readings:**

- Neeraj Pratap Singh, 2005. Basic concepts of Fruit Science 1st Edn. IBDC Publishers.
- Gardner/Bardford/Hooker, J.R.. Fundamentals of Fruit Production. Mac Graw Hill Book Co., New York.
- Kumar, N., 1990. Introduction to Horticulture. Rajyalakshmi publications, Nagarcoil, Tamil Nadu.
- Chadha,K.L.(ICAR), Handbook of Horticulture. ICAR, NewDelhi
- Kausal Kumar Misra and Rajesh Kumar, 2014. *Fundamentals of Horticulture*. Biotech Books.

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Principles of Seed Technology**  
**Paper Code: AG223**  
**w.e.f. Session 2019-20**

**Theory**

**3(1+2)**

**Unit 1.**

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed.

**Unit 2.**

Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test.

**Unit 3.**

Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production. Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage

**Unit4.**

Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

**Practical**

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

**Suggested Readings:**

- Rattan Lal Agarwal. Seed Technology. 1995. 2<sup>nd</sup> edn. Oxford & IBH Publishing Pvt Ltd
- Sluis en Groot . 1985. Methods of Artificial Seed Testing. Enkhuizen (Holland) revised form
- International Rules for Seed Testing. ISTA (1985). Seed Science and Technology 13: 299-355.
- Schmidt, L. 2000. Guide to Handling Tropical and Subtropical Forest Seed. Danida

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Statistical Methods**  
**Paper Code: MT223**  
**w.e.f. Session 2019-20**

**Theory**

**2(1+1)**

**Unit 1.**

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability.

**Unit 2.**

Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

**Unit 3.**

Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in  $2 \times 2$  Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification.

**Unit 4.**

Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

**Practical**

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for  $2 \times 2$  contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

**Suggested Readings:**

- Cochran, W.G. and Cox, G.M. Experimental Design. Asia Publishing House.
- Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley
- Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8thEdn. World Press, Kolkata.
- Casella, G, (2008). Statistical Design. Springer. 6. Gupta, S.C. and Kapoor, V.K. Latest Revised Edition 2015. Fundamentals of Applied Statistics.



**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Agricultural Marketing, Trade and Prices**  
**Paper Code: BM272**  
**w.e.f. Session 2019-20**

**Theory**

**3(2+1)**

**Unit 1**

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets. Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities;

**Unit 2**

Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread:

**Unit 3**

Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India;

**Unit 4**

Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

**Practical**

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

### **Suggested Readings:**

- SS Acharya and N L Agarwal. 2005. *Agricultural Marketing in India*. Oxford and IBH Publishing Co. Pvt. Ltd
- Chandra P. 1984. *Projects: Preparation, Appraisal & Implementation*. McGraw Hill Inc.
- Dewett, K.K. and Chand, A.1979. *Modern Economic Theory*. S.Chand and Co., New Delhi
- Dewett, K.K. and Varma, J.D. 1986. *Elementary Economics*. S.Chand and Co., New Delhi.
- Gupta RD & Lekhi RK. 1982. *Elementary Economic Theory*. Kalyani Publishers.
- Kotler Philip and Armstrong. *Principles of Marketing*. Prentice-Hall.
- Jhingan, M.L. 2012. *Macro Economic Theory*. Vrinda publishers, New Delhi .

**B. Sc. (Hons.) Agriculture**  
**SEMESTER-IV**  
**Syllabus: Introductory Agrometeorology & Climate Change**  
**Paper Code: AG224**  
**w.e.f. Session 2019-20**

**Theory**

**2(1+1)**

**Unit 1.**

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;

**Unit 2.**

Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud;

**Unit 3.**

Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave.

**Unit 4.**

Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

**Practical**

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

**Suggested Readings:**

- G.S. L.H .V.Prasad Rao, 2008. Agricultural Meteorology. Prentice Hall of India Pvt. Ltd., New Delhi.
- H.S.Mavi and Graeme J.Tupper, 2005. Agrometeorology - Principles and applications of climate studies in agriculture. International Book Publishing Co., Lucknow.
- H.S.Mavi, 1994. Introduction to Agrometeorology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- H.V.Nanjappa and B.K.Ramachandrappa, 2007. Manual on Practical Agricultural Meteorology. Agrobios India. Jodhpur.