

**Integral University, Lucknow**  
**Integral Institute of Agricultural Science and Technology**  
**Evaluation Scheme of Undergraduate program**  
**B. Sc. (Hons.) Agriculture**  
**w.e.f. Session 2020-21**

**Elective Courses**

| 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 |
|-------------|---|------------------------|---|---|----------------------------------|----|-----------|---|----|-----------|--------------|------------------------------|---------------------|---------------|--------|---------------------|
|             |   |                        |   |   |                                  |    |           | Sessional                               |    |           | End sem exam | Sub Total (sessional + exam) |                     |               |        |                     |
|             |   | L                      | T | P | CT                               | TA | Total     | CT                                      | TA | Total     | Total        |                              |                     |               |        |                     |
| AG348       | <b>Food Safety and Standards</b>        | 2                      | 0 | 2 | 10                               | 10 | <b>20</b> | 5                                       | 5  | <b>10</b> | <b>20</b>    | <b>50</b>                    | <b>50</b>           | <b>100</b>    | 2:0:1  | <b>3</b>            |
| AG349       | <b>Biopesticides and Biofertilizers</b> | 2                      | 0 | 2 | 10                               | 10 | <b>20</b> | 5                                       | 5  | <b>10</b> | <b>20</b>    | <b>50</b>                    | <b>50</b>           | <b>100</b>    | 2:0:1  | <b>3</b>            |
| HT330       | <b>Protected Cultivation</b>            | 2                      | 0 | 2 | 10                               | 10 | <b>20</b> | 5                                       | 5  | <b>10</b> | <b>20</b>    | <b>50</b>                    | <b>50</b>           | <b>100</b>    | 2:0:1  | <b>3</b>            |

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

**B.Sc. (Hons.) Agriculture**  
**Syllabus: Food Safety and Standards**  
**Paper 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**  
**Syllabus: Biopesticides & Biofertilizers**  
**Paper 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; Cyanobacterial 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**  
**Syllabus: Protected Cultivation**  
**Paper 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, liliium, 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.