SECTION VII
FACULTY OF AGRICULTURE

General Information

Disciplines

- Animal Science
- Agricultural Biotechnology
- Agricultural Meteorology
- Agronomy
- Entomology
- Extension Education
- Food Science and Technology
- Floriculture and Landscaping
- Forestry and Natural Resources
- Fruit Science
- Plant Breeding and Genetics
- Plant Pathology
- Nematology
- Soil Science
- Vegetable Science
- Course curriculum for B.Sc.Agri. (Hons.) 4 year Programme
- Course curriculum for B.Sc.Agri. (Hons.) 6 year Programme for first two years
- Course curriculum for B.Tech. Food Technology 4 year Programme
- Course curriculum for B.Sc. Biotechnology (Hons.) 4 year Programme
- Course curriculum for 2 year Certificate Course in Agriculture
Agricultural education on scientific lines was started in India in the beginning of twentieth century. The Punjab Agricultural College and Research Institute, Lyallpur, was established in 1906 and admission to a 3-year diploma course was started in 1909. Teaching was in the local language Urdu and the diploma award was called Licentiate in Agriculture (L. Ag.) This college was affiliated to Punjab University, Lahore, in 1917 and the diploma course was replaced by a 4-year degree course leading to B.Sc. in Agriculture. Admission to the degree programme was based on merit and the seats were allocated to different commissionaries proportionate to the population. Subsequently the candidates were selected on merit according to the Communal Award.

During the first two years of 4-year degree programme, primarily courses on basic sciences and humanities were taught. However, agriculture with substantial emphasis on field practicals formed part of the instructions from first year of the degree programme. There was a university examination at the end of two years and a certificate was awarded to the successful candidates who passed as Fellows of Science in Agriculture (F.Sc. Agri.). Only those students who passed this examination were allowed to continue further studies for B.Sc. (Agri.) degree.

After independence in August 1947, a "Refugee College" was opened in November, 1947 in a part of the building of Khalsa College, Amritsar, for the migrated students and the staff appointed by the East Punjab Government. Different persons acted as Officers-in-Charge of the college. In the meantime, building of the Malwa Khalsa High School, Ludhiana, was rented by the Government to start the college as an independent institution. An advance team of four faculty members was sent to Ludhiana to take charge of the building. Dr Dalip Singh was appointed the first Principal of the college which opened at Ludhiana in September 1949 with 40 students.

One thousand and five hundred acres of evacuee land of Haibowal and the adjoining villages like Sunet, Rajpura, etc. near Ludhiana was allotted to the college by the Government for establishing a teaching and research institute at the present site of the Punjab Agricultural University. The foundation stone was laid by Sh Ajit Prasad Jain Union Minister for Food and Agriculture, GOI on 23rd September 1955 and the college started functioning in the new building in September 1958.

The Government Agricultural College, Ludhiana was headed by various principals, namely, Dr Dalip Singh (July 1949 to April 1952), Sh H R Saini (April to August 1952 and November 1952 to January 1953), Sh B S Sahney (August 1953 to July 1954), Dr M R Madhok (August to November 1952, January to August 1953 and August 1954 to October 1957), Dr S S Purewal (October 1957 to July 1960), Dr Kishan Singh Bedi (February to July 1960) and Dr Sardar Singh (November 1960 to June 1962).

With the establishment of Punjab Agricultural University in 1962, the college was headed by the Deans of the Faculty of Agriculture, namely, Dr Gursham Singh (June 1962 to September 1966), Dr A S Atwal (September 1966 to November 1973 and, again, from October 1975 to July 1979), Dr Sukhdev Singh (November 1973 to February 1974), Dr N S Randhawa (February 1974 to October 1975), Dr K S Gill (August 1979 to February 1983), Dr G S Gill (February 1983 to May 1984), Dr D S Dev (September 1985 to September 1989), Dr K S Aulakh (September 1989 to May 1994), Dr M S Bajwa (August 1994 to June 1998), Dr P S Sidhu (June 1998 to March 2001), Dr M S Tiwana (June 2001 to May 2005), Dr G S Chahal (July 2005 to January 2008), Dr M S Aulakh (February 2008 to August 2010). Dr D S Cheema (Sept. 2010 to February 2013). Since March 2013, Dr H S Dhaliwal is Dean of the College.

Before the establishment of PAU, the B.Sc. (Agri.) programme was organized on the old annual system of the Punjab University, Lahore/Solan/Chandigarh. Under the new regulations of the Panjab University, Chandigarh, introduced in 1961, two concurrent programmes were offered viz. 5-year programme after matriculation and 4-year programme after pre-university or higher secondary. The number of students admitted to the two programmes was 80 and 170, respectively. The aggregate marks obtained in four years out of maximum were shown on the transcript of B.Sc. (Agri.) graduate in order to indicate the consistency of the performance of the students.
After the establishment of PAU, a new educational system was introduced with the collaboration of Ohio State University, Columbus (USA). The trimester system of education with complete internal assessment was introduced for M.Sc. and Ph.D. programmes in 1963 and for B.Sc. (Agri.) programme in 1964. The students who were already enrolled in these programmes were allowed to continue their studies according to the previous regulations in vogue. The number of students admitted was increased to approximately 250 per year but subsequently in 1974, the admission capacity was stabilized around 170 per year. A separate programme for admitting 25 inservice Nepalese students was also started.

At the time of independence in 1947, some M.Sc. and one Ph.D. student who were earlier registered with the Punjab University, Lahore, continued their research for the fulfilment of their degree requirements as private candidates. The Punjab University also framed rules for registering postgraduate students to complete their degrees based on thesis research. In 1961, new rules were framed which required such students to appear in three theory papers and practicals having a maximum of 400 marks, which they had to clear and the marks so obtained were added to the thesis marks which were awarded out of 300.

Under the ICAR programme of establishing centres of postgraduate education in the country, the College of Agriculture was also approved as one of such centres. Simultaneously, the regulations were modified by the Panjab University, Chandigarh and weightage to the thesis research was reduced. There were 450 maximum marks for theory and practicals, and 250 for thesis research. Another important feature introduced was the provision to admit regular students and the registered private candidates (only the teachers) were allowed to appear in the examinations and submit the thesis.

This system of education had just stabilized when the Formation of the Agricultural University Act was passed in October 1961. The previous system was continued for one year under the PAU, so that the already admitted students could complete their degrees. The new trimester system of education and the consequent rules and regulations became operative in July 1963 under the 'Statutes of the Punjab Agricultural University.' Regular admissions to M.Sc. and Ph.D. programmes in the existing departments of the College of Agriculture were made from August 1963.

In the Department of Agriculture, Punjab, the teaching and research was entrusted to various subject-matter Heads of Sections who were also designated as College Professors. With the establishment of PAU, these sections were upgraded as university departments and were headed by full professors. The chronological establishment of the Departments in the College of Agriculture was as under:

- Department of Agronomy (1963)
- Department of Animal Science (1963) [Shifted to GADVASU in 2006]
- Department of Entomology (1963)
- Department of Extension Education (1963)
- Department of Horticulture (1963) [Now department of Fruit Science]
- Department of Plant Breeding (1963) [Now Department of Plant Breeding and Genetics]
- Department of Plant Pathology (1963)
- Department of Soil Science (1963)
- Department of Food Science and Technology (1969)
- Department of Vegetable Crops, Landscaping and Floriculture (1974) [Now department of Vegetable Science]
- Department of Forestry and Natural Resources (1979)
- Department of Agrometeorology (1981) [Now School of Climate Change and Agricultural Meteorology (2012)]
- Department of Animal Nutrition and Forages (1991) [Shifted to GADVASU in 2006]
- Department of Seed Science and Technology (1991)
- Department of Floriculture and Landscaping (1994)
- School of Agricultural Biotechnology (2008)
In May 1998, the Departments of Animal Science and Animal Nutrition were shifted to the College of Veterinary Science. The Department of Seed Science and Technology was upgraded to Directorate of Seed Science and Technology under Director of Research in July 1999. The Department of Agrometeorology was merged with the Agronomy Department and a new Department of Agronomy and Agrometeorology was created in March 2002. The Department of Home Science Extension Education of the College of Home Science was shifted to the College of Agriculture and merged with Department of Plant Breeding and the new Department of Plant Breeding, Genetics and Biotechnology was created in September 2003. The Department of Forestry and Natural Resources was merged with Department of Agronomy & Agrometeorology and new Department of Agronomy, Agrometeorology and Forestry was created in June 2006. The Department of Business Management of the College of Basic Sciences and Humanities was shifted to the College of Agriculture in November, 2006. The Department of Foods & Nutrition of the College of Home Science and Department of Processing & Food Engineering of the College of Agricultural Engineering were shifted to the College of Agriculture and merged with Department of Food Science & Technology and new Department of Food Science & Engineering was created in December, 2006. The Departments of Vegetable Crops and Floriculture & Landscaping were merged and a new department named as Vegetable Crops, Floriculture and Landscaping was created in April, 2007. The merger of Departments were again dissolved in 2007 and all these Departments were demerged and created two schools for the efficient working. Thus, the college now has 13 departments and two Schools.

Due to inherent complexities of switching over from one system to another, the transitional period from the conventional annual system of external examinations to the trimester system, with complete internal assessment, was inevitably a difficult one. In fact, the College of Agriculture was the first in India to successfully adopt the new system. With the hard work of faculty and the patience and cooperation of students, complete switch over to the new system was accomplished by the academic year 1968-69. The innovations in agricultural education and the rules and regulations framed to suit local conditions were accepted by the students. Most of these rules were subsequently adopted by other State Agricultural Universities in India.

By way of background, in 1963-64, the existing subjects as taught under the old annual system were hurriedly sub-divided into trimester courses for undergraduate and postgraduate programmes. Based on experience during the formative years, the course curriculum was rationally revised and operationalized in 1969. This revision was concurrent with the needs of the agricultural revolution which was already ushered in the state.

During seventies, agriculture in Punjab witnessed very rapid changes. The farmers became progressive and made heavy demands on agricultural education to meet the requirements of knowledge for intensive use of inputs, farm mechanization and diversification of agriculture. Hence the progressive agriculture in Punjab called for dynamic agricultural educational programme and the curricula. A critical revision of the various courses for B.Sc. (Agri.) programme was made which took almost one year. The new programme became operative in August 1973. The most significant feature of this programme was that the earlier concept of offering one major subject to the students in the final year, representing one of the thirteen departments, was changed and the disciplines were combined according to the professional specializations. The six new areas of elective subjects were: Crop Sciences; Animal Sciences; Soil Sciences; Plant Protection; Economics, Sociology and Extension Education; and Food Science, Technology and Nutrition. The new degree was renamed as B.Sc. (Agri.) with 'Honours' in one of these six specialized areas. The first batch students of B. Sc. (Agri.) Hons. were Graduated in 1976.

In 1974, "Earn While You Learn" schemes in the respective electives for the final year students were started. Revolving funds were created in various departments to meet the cost of inputs which were supplied to the students on loan from the common pool. When the produce was ready, they were encouraged to sell it in the market. The income from the saving of labour and innovative use of inputs was shared by the students. These activities included poultry farming, floriculture, food technology, nursery growing, dairy farming and vegetable growing. At present this scheme is operative only in Crop Production Courses (CPC) under the department of Agronomy.

The fourth revision of the course curricula for B.Sc. Agri. (Hons) was made in 1982 by maintaining the essential features of the degree programme and incorporating the recommendations of the second Deans' Committee of the ICAR and the National Commission on Agriculture.
Consequent upon the decision of the university to switch over from the trimester to semester system of education from the academic session 1988-89, the course curricula for undergraduate and postgraduate programmes were revised, updated and reoriented. The practical component of the curricula was considerably strengthened. The minimum qualification for admission to B.Sc. Agri. (Hons.) was raised to 10+2 with science group (medical or non-medical streams) and later on the agriculture stream was also included. The revised curricula in the light of the recommendations of third Deans’ Committee of ICAR and the syllabi for National Eligibility Test conducted by ASRB (for PG Programmes) have been implemented with effect from academic session 1998-99. At present, the recommendations of fourth Deans’ Committee have also been implemented for all UG programmes with effect from academic session 2009-10.

One year degree programme in Bachelor of Education was started in 1977 for B.Sc. Agri.(Hons), B.Sc. (Home Science) and B.Tech. (Agri. Engg.) graduates of PAU. A two year Diploma in Dairy Technology was started in 1979 in order to provide technicians for the newly established Milk Chilling Centres and Milk Processing Plants in the state. This programme was discontinued in 1991 due to lack of employment opportunities. The one year certificate course for Agricultural Sub Inspectors was modified into a two year Diploma in Agriculture in 1983, with an option to the students to terminate studies at the end of one year certificate course or to complete the diploma course. With the establishment of an 'Institute of Agriculture' at Gurdaspur in 1993, this diploma course was shifted there. In 1985 four year B.Sc. (Forestry) programme was started but it was discontinued in 1987. One year ‘Certificate Course in Pesticides and Fertilizers’ was started in 1993. This was, however, discontinued in 1998 due to lack of employment opportunities for these students. Thereafter, the college started new Diploma programmes in Apiculture, Pest Management, Food Technology & Seed Production from the academic year 2005-06 which were discontinued from academic session 2007-08.

Apart from B.Sc. Agri. (Hons) and B.Ed. programme, the college now offers M.Sc. programme in 14 disciplines and Ph.D. programmes in 12 disciplines. Keeping in view the sustainability of agricultural production in Punjab, new programmes at undergraduate and postgraduate level were initiated as B.Sc. Agri.(Hons.) 6-year programme after Matric (2008-09); B.Sc. Biotechnology (Hons.) 4-year programme; B Tech. Food Technology 4-year programme (Both under self supporting system after 10+2 medical or non-medical streams); Two year Certificate Course in Agriculture at Institute of Agriculture, Gurdaspur (2009-10); PG programmes started were M.Sc. Biotechnology (2008-09), Ph. D. Biotechnology (2009-10), Ph.D. Floriculture & Landscaping (2010-11) and recently M.Sc. Nematology (2011-12).

Realising the tremendous potential of biotechnology in increasing agricultural productivity, the University established an independent ‘School of Agricultural Biotechnology’ on April 24, 2008. The School is equipped with basic infrastructural research facilities for carrying out research on various aspects of Agricultural Biotechnology. There is a separate building named after Food Laureate, Dr G S Khush, with 18 laboratories for conducting research on plant tissue culture, plant transformation, molecular biology, molecular cytogenetics, genomics laboratories and temperature, humidity and light controlled facility apart from a fully functional Bioinformatics Centre. A Super Computer has recently been installed in the University for conducting research related to Computational Biology in Biotechnology. The School has collaborations and funding from the John Innes Centre, Norwich, UK., University of Nottingham, England; University of Tokyo, Japan; IRRI, Philippines; Ohio State University, USA ; University of Zurich, Switzerland; Texas A & M University, USA; Kansas State University, USA; University of Sydney, Australia and ICGEB, New Delhi.

Wheat genome sequencing project is a globally ambitious research programme in which 16 countries are involved under the umbrella of IWGSC (International Wheat Genome Sequencing Consortium). India has been entrusted with the responsibility of sequencing of Chromosome 2A, which is about 900 Mbp and is 2.5 times larger than the whole rice genome. Dept. of Biotechnology (DBT), Ministry of Science and Technology, Government of India funded this collaborative programme to the PAU, National Research Centre on Plant Biotechnology (NRCPB) New Delhi and University of Delhi South Campus (UDSC), New Delhi with a total budget of Rs 34 crore for a period of three years. PAU is the lead centre with a total budget of Rs 18 crore.

School of Climate Change and Agricultural Meteorology has recently been established in 2012 upgrading the Department of Agricultural Meteorology with the objectives to undertake focused research on developing suitable
technologies for sustaining natural resources and agricultural productivity under changing climate scenario and to impart quality education to undergraduate and postgraduate students on different aspects of agricultural meteorology. Scientists from allied disciplines of Agronomy, Soil Science, Entomology, Plant Pathology, and Soil and Water Engineering have been associated to conduct the research work in field of climate change.

Punjab Agricultural University established with a grant from ICAR, a State-of-the-art facility named as Electron Microscopy & Nano-science Laboratory (EMN Lab) in 2007 having Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), Energy Dispersive X-ray Spectroscope (EDS), and Scanning Probe Microscope (SPM), Optical Upright Research Microscope, Ultracut Microtome and Cryo Attachment, and Ion Sputter Coater facilities. The latest high resolution imaging tools in the EMN Lab for imaging particles as small as 1 nanometer (1 billionth of a meter) would enable scientists to develop technologies relevant to agriculture and food systems. It also facilitate research in basic biological, biomedical, chemical and material sciences to support the future needs of precision agricultural research.

The Old Boys' Association (renamed as Alumni Association) of the College was reactivated in 1968 when the regular students offered to contribute Rs.2/- per trimester. Directory of the alumni who graduated in various years was prepared for circulation and republished in 1990. The Association also started a quarterly magazine of its own under the name of "AGALUMNUS" This Association has published many books and Laboratory Manuals for improving the quality of agriculture teaching. A book bank was started in the college out of funds contributed by students. The books are issued to students on loan for a semester.

The student advisement which formed an essential and desirable feature of the trimester system of education has been considerably strengthened under the semester system. The advisors devote considerable time advising the students about curricular, co-curricular, social and emotional problems and serve as guides, mentors, role models and 'guardians-on-the-campus' for their advisees. With wise counselling and guidance by the faculty accompanied by receptive and proactive policies of the college, the defaults of the students have been considerably reduced facilitating timely completion of their degrees. The College has established a centrally located Placement and Counselling Cell, to provide the students with access to wide range of temporary and permanent jobs by organizing campus interviews or through building their competence to face interviews, personality development and coaching for various competitive examinations.

The students' interest are taken care of by providing them ample opportunities to exercise choice for courses in various fields of specialization. Within the confines of their limits, the autonomy of the teachers is assured, which is so essential under the system of internal evaluation. In order to ensure full coverage of the course contents, lecture outlines and references to the books and other relevant literature are distributed to the students in the beginning of the semester. The lesson plans and lectures of undergraduate courses on multimedia have been introduced for teaching from academic session 2004-05. Every student admitted to Bachelor's degree (w.e.f. academic session 2012-13) course is required to participate in any one of the three fold programmes namely NCC, NSO and NSS for first four semesters of their studies which was earlier for two semesters.
ANIMAL SCIENCE

Undergraduate Courses

LPM 91 Animal Science-I 2+1 Sem. I
Importance, advantages and limiting factors in livestock, poultry and fish farming. Importance of milk, meat and egg in human food. Common terms and breeds/species of cattle, buffalo, sheep, goat, pig, poultry and fish. Breeding, housing, feeding and general management of different categories of livestock and poultry. Artificial Insemination, pregnancy diagnosis and detection of estrous in dairy animals. Scientific fish farming. Important diseases of livestock, poultry and fish along with their preventive measures.


LPM 205 Livestock Production and Management 2+1 Sem. II

AGRICULTURAL BIOTECHNOLOGY

PROGRAMMES
1. M.Sc. Biotechnology
2. Ph.D. Biotechnology

COURSE REQUIREMENT

M.Sc.
Field of Specialization
Plant Tissue Culture and Transformation, Molecular Biotechnology

Required Courses
Biotech. 501, Biotech. 502, Biotech. 503, Biotech. 504, Biotech. 505

Supporting Courses
Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Plant Breeding & Genetics, Microbiology, Biochemistry, Botany, Plant Pathology, Entomology or any other as approved by Dean, Postgraduate Studies

Deficiency courses for students with elective other than Plant Breeding, Genetics and Biotechnology
9-12 credit hours of at least 400 series courses as recommended by the Student’s Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.
Field of Specialization
Plant Tissue Culture and Transformation, Molecular Biotechnology

Required Courses
Biotech. 601, Biotech. 602, Biotech. 603, Biotech. 604

Supporting Courses
Courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Plant Breeding & Genetics, Microbiology, Biochemistry, Botany, Plant Pathology, Entomology or any other as approved by Dean, Postgraduate Studies

Deficiency Courses for students with M.Sc. (Agri.) in a discipline other than Biotechnology
Biotech. 501, Biotech. 502, Biotech. 503, Biotech. 504, Biotech. 505 and other courses as recommended by the Student’s Advisory Committee.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Biotech. 101 Introduction to Biotechnology  

Biotech. 102 Food Biotechnology  

Biotech. 301 Fundamentals of Recombinant DNA  
Emergence of Molecular Biology; DNA, RNA and protein synthesis; Recombinant DNA technology: Restriction endonucleases, cloning vectors, plasmids, cosmids, phagemids, BACs, PACs, YACs, MACs, Transposon vectors, Expression vectors, Shuttle vectors, Binary plant vectors, Cointegrating vectors; Strategies to develop vectors; Restriction enzymes, restriction cleavage, construction of chimeric DNA, Genetic transformation of E. coli and selections; applications of chimeric DNA; Basic techniques of agarose gel electrophoresis, Nucleic acid blotting, Southern blotting, Northern blotting, Western blotting, preparation of probes, PCR and gene amplification, DNA sequencing; Creating and screening of library.  
Practical: Orientation of recombinant DNA lab, preparation of stock solutions and buffers, plasmid DNA isolation, Genomic DNA isolation, restriction digestion of DNA, Agarose gel electrophoresis, PCR, genetic transformation of E. coli, Screening of recombinant DNA clones in E. coli.

Biotech. 302 Introduction to Plant Tissue Culture


**Biotech. 303 Introduction to Nanobiotechnology** 2+0 Sem. I
Concepts and Terminology; Nano-Bio Interface; Biological based Nanosystems, molecular motors, biosensors and other devices; Self assembly of molecules for nanotechnology applications; Biomimetics, Biotemplating and de-novo designed nanostructures and materials; DNA-Nanotechnology; Nanobiotechnology use in bioanalytical technology; Nanomanipulations, material design and synthesis and their applications.

**Biotech. 304/Micro. 303 Introduction to Industrial Biotechnology** 2+1 Sem. II

**Biotech. 305 Introduction to Molecular Biology** 2+0 Sem. II
Introductory module that provides a broad overview of molecular biology concepts relevant to the plant sciences. Structure and variation of prokaryotic and eukaryotic nuclear and organelle genomes, including changes in genome size. Plasmids - types, construction and use in molecular biology. Construction, maintenance and uses of genomic and cDNA libraries. Polymerase chain reaction - principle and applications. Molecular markers- their development and use in genetic and physical mapping and molecular breeding. Positional gene cloning, genomic sequencing and comparative genomics.

**Biotech. 306 Introduction to Molecular Genetics** 2+0 Sem. II

**Biotech. 307 Introduction to Bioinformatics** 2+1 Sem. II

**Biotech.308 Instrumentation in Biotechnology** 0+2 Sem. II
Biotech. 309 Introduction to Cell Biology  2+1  Sem. II
Origin and evolution of cell; Cells as experimental model; Functional organization of a cell; Structure and composition of the plasma membrane, cell wall and extracellular matrix; Cytoskeleton and cellular interactions; Water relations and ion transport mechanisms; Endomembrane system- endoplasmic reticulum, Golgi apparatus and lysosomes; Bioenergetics and metabolism- mitochondria, chloroplast and peroxisomes; Cell cycle and cell signaling mechanisms; The nucleus- nuclear envelope, organization of nucleolus and chromatin, genomes, DNA and flow of genetic information; Mutations; Cell death and cell renewal.
Practical: Fractionation of cell contents by differential centrifugation; isolation and purification of rough and smooth reticulum, Golgi stacks and mitochondria; Membrane permeability and transport properties; Preparation of materials for microscopic studies; Procedures for counting and distinguishing live and dead cells; Cell culture techniques.

Biotech. 310 Principles of Plant Biotechnology  2+1  Sem. I
Undergraduate Elective/M.Sc. supporting/Minor Courses

Biotech. 311 Introduction to Plant Tissue Culture and Genetic Transformation  2+1  Sem. I

Biotech. 312 Introduction to Molecular Biotechnology  2+1  Sem. II
Genome organization of prokaryotes and eukaryotes; Restriction endonucleases- classification, properties and uses in molecular biology; Recombinant DNA technology; Construction and uses of genomic and cDNA libraries; Southern, Northern and Western Hybridization; RFLPs; Polymerase Chain Reaction and its variants; PCR based markers like RAPDs, SSRs, AFLPs, SNPs and their variants; uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding; DNA sequencing; gene cloning approaches.

**Biotech. 313 Environmental Biotechnology**


**Biotech. 401 Introduction to Genomics and Proteomics**


**Biotech. 402 Fundamentals of Cytogenetics & Molecular Cytogenetics**


**Biotech. 403 Techniques in Molecular Biology-I**


**Biotech. 404 Computational Biology**

Bioinformatics and metabolic engineering. Introduction to databases on the web, LIGAND. Enzyme databases: BRENDA, A primer on enzyme nomenclature. Searching and analyzing enzyme data, Metacyc. Single nucleotide polymorphisms (SNPs); SNP detection methods: SSCP, PCR based, DGGE, TGGE, dHPLC sequencing. SNP and disease. Polymorphism versus Mutations. SNP database – dbSNP. SSR


Biotech. 406 Functional Genomics  2+0  Sem. I

Biotech. 433 Principles and Procedures of Plant Tissue Culture and Transformation  2+1  Sem. I


Biotech. 434 Principles and Procedures of Molecular Biotechnology and Genomics  2+1  Sem. I

Practical: Isolation, purification and fractionation of DNA and proteins. Isolation and purification of plasmids. Measurement of protein and nucleic acid concentration using photospectrometer. DNA amplification using RAPD/SSR primers and its fractionation in agarose gel. Generation of linkage maps and mapping of qualitative genes using important web sites on computer.

Biotech. 499 In-house Project Training  0+20  Sem. II
After the completion of the course work, the B.Sc. Biotechnology (Hons.) students would undergo compulsory In-house Project Training on various aspects of Biotechnology for the duration of one semester. The students will submit plan of work to the class teacher(s) within two weeks of joining and detailed project report two weeks prior to the end of the semester. The evaluation of the In-house Training will be based on the project report submitted and oral presentation cum viva voce.

Postgraduate Courses

Biotech. 501 Plant Tissue Culture and Genetic Transformation  2+1  Sem. I
Plant cell and tissue culture its importance and history. Culture media for callus, suspension, nurse, root, meristem, etc. In vitro differentiation. Plant growth regulators. Molecular basis of plant organ differentiation. Various aspects of plant tissue culture micropropagation, anther and microspore culture, somaclonal variation, embryo rescue, wide hybridization, in vitro mutagenesis, in vitro fertilization and in vitro germplasm


**Biotech. 502 Principles of Biotechnology**  
2+0  
Sem. II  

**Biotech. 503 Principles in Structural and Functional Genomics**  
3+0  
Sem. I  

**Biotech. 504 Techniques in Structural and Functional Genomics**  
0+2  
Sem. I  

**Biotech. 505 Techniques in Molecular Biology-II**  
0+2  
Sem. II  

**Biotech. 506 Molecular Cell Biology**  
3+0  
Sem. I  
General structure and constituents of cell. Similarities and distinction between plant and animal cells. Cell wall, cell membrane, structure and composition of biomembranes, cell surface related functions. Structure

**Biotech. 507/ Micro. 504 Industrial Microbiology** 2+1 Sem. II


Practical: Isolation, maintenance and improvement of industrial important organisms. Production of alcohol, beer, citric acid, lactic acid and their recovery; Study of bio-reactors. Production of biofertilizers and biogas. Demonstration of activity of immobilized enzymes/cells.

**Biotech. 508 Nanobiotechnology** 3+0 Sem. II


**Biotech. 509 Bioinformatic Tools and their Applications in Agriculture** 2+1 Sem.I & II


Biotech. 601 Advances in Genetic Engineering and Transformation 2+0 Sem. II

Biotech. 602 Advances in Plant Molecular Biology 2+0 Sem. I

Biotech. 603 Advances in Crop Biotechnology 2+0 Sem. II
Conventional versus non-conventional methods for crop improvement. Present status and recent developments on molecular marker systems. Transformation and genomic tools for crop improvement. Genetic Engineering for increasing crop productivity by manipulation of photosynthesis, nitrogen fixation, nutrient uptake efficiency, quality improvement (protein, essential amino acids, vitamins, mineral nutrients, etc). Edible vaccines. Molecular breeding- constructing molecular map. Integrating genetic, physical and molecular maps. Diversity assessment and phylogenetic analysis. Molecular tagging of genes/traits. Selected examples on marker assisted selection of qualitative and quantitative traits. Discussions on application of molecular markers and genomic tools for the genetic enhancement in some major field and horticultural crops such as rice, wheat, cotton, maize, soybean, oilseeds, sugarcane, banana, grapes and papaya etc.

Biotech. 604 Advances in Functional Genomics and Proteomics 2+0 Sem. I

Biotech. 605/Micro. 605 Advances in Microbial Genetics and Biotechnology 2+0 Sem. II
engineering, recombinant DNA technology-DNA isolation, vector designing, cloning, PCR amplification, expression of genes and its application in industry and agriculture. Concepts of proteomics and genomics.

Biotech. 606 Commercial Plant Tissue Culture 2+0 Sem. I

Biotech. 607 Advances in Bioinformatics 0+2 Sem. I

Biotech. 591 Seminar
Biotech. 600 Master's Research
Biotech. 700 Ph.D. Research
AGRICULTURAL METEOROLOGY

PROGRAMMES
1. M.Sc. Agricultural Meteorology
2. Ph.D Agricultural Meteorology

COURSE REQUIREMENT

M.Sc.
Field of Specialization
Climate Change, Microclimate Modifications, Crop Modeling, Crop-weather-pests interactions.

Required Courses
Agromet. 501, Agromet. 502, Agromet. 503, Agromet. 504, Agromet.505

Supporting Courses
Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Agronomy, Entomology, Plant Pathology, Soil Science, Math., Vegetable Science or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

with elective other than Agronomy,

Soil Science, Forestry

Ph.D.
Field of Specialization
Climate Change, Microclimate Modifications, Crop Modeling, Crop-weather-pests interactions.

Required Courses
Agromet.601 , Agromet. 602, Agromet.603

Supporting Courses
Stat. 515 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Agronomy, Entomology, Plant Pathology, Soil Science, Math., Vegetable Science or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students
Agromet. 501, Agromet. 502, Agromet. 503, Agromet. 504, Agromet.505 and other courses as recommended by Student's Advisory Committee

with M.Sc. (Agri.) in a discipline other than Agricultural Meteorology
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Agromet. 102 Introductory Agrometeorology 2+1 Sem. I & II

Postgraduate Courses

Agromet. 501 General Meteorology and Climatology 2+1 Sem. I
Practical: Agromet observatory-different classes of observatories. Site selection and installation procedures for meteorological instruments. Measurement and recording of weather parameters. Climatic normals, weather chart preparation and identification of low and high pressure systems. Statistical techniques for computation of normals, moving average, Markov chain model etc.

Agromet. 502 Applied Agricultural Meteorology 2+1 Sem. II

Agromet. 503 Micrometeorology 2+1 Sem. II


Agromet. 504 Agrometeorological Measurements and Instrumentation 2+1 Sem. I
Fundamentals of measurement techniques. Theory and working principles of barometers, thermometers, psychrometers, hair hygrometer, thermohygrograph, radiation and temperature instruments, pressure bomb apparatus, precipitation and dew instruments, wind instruments, potometer, photosynthesis system, leaf area meter, soil thermometers and soil heat flux plates. Automatic weather station. Computation and interpretation of data.
Practical: Working with the above instruments in the meteorological observatory, taking observations of relevant parameters. Exposure and operation of meteorological instruments/equipments in agromet observatories. Computation and interpretation of the data.

Agromet. 505 Soil Water Balance Climatology 2+1 Sem.II

Agromet. 506 Crop Weather Models 2+1 Sem. I
Practical: Working with statistical and simulation models, DSSAT models, BRASSICA etc.

Agromet. 507 Weather Modification and Risk Management Strategies 2+0 Sem. II

Agromet. 508 Principles of Remote Sensing and their Applications in Agriculture 2+1 Sem. I


Agromet. 509 Applied Agricultural Climatology 2+1 Sem. II


Agromet. 601 Advanced Weather Forecasting 3+0 Sem. I

Agromet. 602 Analytical Tools and Methods for Agricultural Meteorology 3+0 Sem.II

Agromet. 603 Strategic Use of Climate Information 3+0 Sem. II
Awareness and history of climate-related disasters. Hazards and their relation to agricultural production risks and their mitigation. Selection of appropriate land use and cropping patterns- history and environmental issues, success and difficulties experienced by farmers and outlook for possible alternatives. Agro-
meteorological aspects for making more efficient use of agricultural inputs. Selection of livestock management- history related to environmental issues. Adoption of microclimate modification techniques. Protection measures against extreme climate-history of protection measures against extreme climate in the continent/region/country/sub region concerned, successes and difficulties experienced by farmers with present protection measures, outlook for present protection measures and possible alternatives. Trends in protection methods against extreme climate.

**Agromet. 604 Climate Change and Sustainable Development**  
2+0  
**Sem. I**

**Agromet. 605 Advanced Micrometeorology**  
2+0  
**Sem. II**

**Agromet. 606 Agrometeorological Data Base Management and e-Services**  
2+1  
**Sem. I**
Data, information and types of data-climate, soil and crop data. Importance of database management, data requirements, collection and recording. Data structure/format and quality control of data. Techniques of climatic data generation and missing data. Introduction to different software for database management. Processing and analysis of data and data products. Value addition of data and data products-data users, public, commercial, academic/research. Availability, accessibility and security of data. Evaluating the cost of data.
Practical: Types of instruments and data recording. AWS data retrieval, storage and transfer. Exposure to different software for Agromet data analysis; exposure to Statistical software. Temporal and spatial analysis of data; exposure to GIS. Value addition to data. Uploading and downloading data, password and security of data. E-management of data.

**Agromet. 591 Seminar**
**Agromet. 600 Master’s Research**
**Agromet. 700 Ph.D. Research**
AGRONOMY

PROGRAMMES

1. M.Sc.
2. Ph.D.

COURSE REQUIREMENT

M.Sc.

Field of Specialization
Agrostology, Crop Ecology, Crop Nutrition, Crop Physiology, Crop Production, Water Management, Weed Science

Required Courses
Agron.501, Agron. 502, Agron. 503, Agron. 504, Agron.505

Supporting Courses
Stat.421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Agrometeorology, Chemistry, Botany, Soil Science, Forestry & Natural Resources, Microbiology or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students with elective other than Agronomy, Soil Science, and Forestry
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.

Field of Specialization
Agrostology, Crop Ecology, Crop Nutrition, Crop Physiology, Crop Production, Water Management, Weed Science

Required Courses
Agron. 601, Agron. 602, Agron. 603, Agron. 604

Supporting Courses
Courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Agrometeorology, Chemistry, Botany, Soil Science, Forestry & Natural Resources, Microbiology or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students with M.Sc.(Agri.) in a discipline other than Agronomy
Agron.501, Agron. 502, Agron. 503, Agron. 504, Agron.505 and other courses as recommended by Student's Advisory Committee
### Undergraduate Courses

#### Agron. 91 Agronomy-I  
**2+1 Sem.I**

- Agriculture, its importance and branches; climate, soil and water in relation to crop production; farm tools and implements; crop seasons; seed structure and germination; phases of plant growth and factors affecting it; mode of propagation; classification and relative status of important crops in the state; importance of water to plants; agronomic practices, seed bed preparation, sowing, fertilizer application; weed control, harvesting, threshing and marketing of important field crops.

- Practical: Land measurements; seed bed preparation; interculture techniques; identification of field crops, their seeds and important weeds; germination of different crop seeds in lab. and field; depth of seed placement in relation to seed size; methods of irrigation; familiarization of agricultural hand tools and implements; maintenance and keeping farm records.

#### PFT-91 Practical Field Training-I  
**0+1 Sem I**

#### PFT-92 Practical Field Training-II  
**0+1 Sem II**

#### Agron. 101 Elements of Agronomy  
**2+1 Sem I**

(For students of B.Sc. Biotech (Hons.) and B.Tech Food (Hons.)-4 year programme)


#### Agron. 105 Agriculture for Engineers  
**3+1 Sem. I**

(In collaboration with Department of Soil Science, Fruit Science and Vegetable Science) (For students of College of Agricultural Engineering & Technology)

- Soil Science: Concept of soil & soil components. Minerals : definition, composition and classification. Rock: definition, composition and classification; Factors of soil formation, parent materials, topography, time, climate and organisms; Soil forming processes, humification, eluviation, illuviation, clacification, gleization, salanization, alkalisation, laterization, podzolization; Physical properties of soil and their importance; Soil colloids, properties and types, structure of silicate and non-silicate colloids; Types of ion exchange; principles governing cation exchange reactions, cation exchange capacity and factors affecting it, cation saturation and nutrient availability; Soil organic matter; composition, decomposition and mineralization; role of organic matter on soil fertility; Soil reaction: concepts, factors affecting soil reaction and its role in nutrient available; characteristics and management of acid, saline and alkali soils; Quality of irrigation water: criteria and guidelines for evaluation of quality of irrigation water; Essential plant nutrients: their functions and deficiency symptoms in plants.


#### Agronomy: Definition and scope of agronomy. Classification of crops, Effect of different weather parameter on crop growth and development. Soil water plant relationship and water requirement of crops, Weeds and their control, Crop rotation, Cropping systems, Relay cropping and mixed cropping. Practical: Identification
of crops and their varieties seeds and weeds, Fertilizer application methods, Different weed control methods, Judging maturity time for harvesting of crop, study of seed viability and germination test.

**Horticulture:** Scope of horticulture crops, soil and climatic requirements for fruits, Improved varieties of fruits, Criteria for site selection for fruits crops, layout and planting methods for fruit plants, nursery raising for fruit crops, Macro and micro propagation methods for fruits plants, plant growing structures, Pruning and training of fruit plants, Manuring and fertilization and fertigation in fruit plants, irrigation methods for fruit plants, Grading and packing of fruits, post harvest practices for fruit crops, Garden tools, Management of orchards.

Practical: Identification and description of fruit plants and varieties, Study of different garden tools and preparation of nursery bed, Practices of pruning and training of important fruit crops. Vegetable Science: Branches of Horticulture, definitions, scope of vegetable cultivation and importance of vegetables in human nutrition, Cultivation of potato: climate, soil, varieties, sowing, seed rate, method of sowing, diseases and pests, seed plot technique, harvesting and post-harvest handling, Cultivation of tomato; climate, soil requirement, time of sowing, transplanting, varieties nursery raising, frost protection, spacing, irrigation, picking and post harvest handling. Cultivation of chilli and capsicum: climate, soil, nursery raising, seed rate, spacing, varieties, hybrid seed production, frost and plant protection, post-harvest handling, Cultivation of root crops; radish, carrot and turnip, their sowing time, seed rate, climate, soil, varieties, spacing, irrigation, nutrients, application, harvesting and marketing. Cultivation of cucurbitaceous crops; climate, nursery raising, seed rate, spacing, varieties, nutrient application, picking and storage.

Practical: Nursery raising and transplanting, Cultivation of potato, root crops and fruit vegetables.

**Agron. 106 Water Management and Microirrigation**

2+1 Sem. II


Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability. Visit to farmers’ field.

**Agron. 203 Principles of Agronomy-I (Kharif Crops)**

2+1 Sem. I


**Agron. 204 Principles of Agronomy -II (Rabi Crops)**

2+1 Sem. II

Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops- wheat, barley, chickpea, lentil, peas, french bean, rapeseed and mustard, sunflower, safflower, linseed, sugarcane, sugarbeet, potato, tobacco and forage crops- berseem, lucerne and oats. National and International Agricultural Research Institutes in India.

**Agron. 205 Organic Farming**

**Agron. 301 Practical Crop Production-I (Kharif Crops)**

**Agron. 302 Practical Crop Production-II (Rabi Crops)**

**Agron. 303 Crop Residue Management**

**Undergraduate Elective/M.Sc. Supporting/Minor Courses**

**Agron. 433 Weed Management**


**Agron. 434 Farming Systems and Sustainable Agriculture**
Farming systems, definition, principles and components. Farming System models for irrigated, dryland situations and modules for marginal, small and large farmers. Farming systems of the world-arable,


Agron. 435 Production Technology of Spices, Aromatic, Medicinal and Plantation Crops 2+1 Sem. I

Practical: Identification of crops based on morphological and seed characteristics. Propagation, seed selection, seed treatment, processing and distillation techniques for different medicinal, aromatic and spice crops.

Postgraduate Courses

Agron. 501 Modern Concepts in Crop Production 3+0 Sem. I

Agron. 502 Fertilizer use in Crop Production 2+0 Sem. I
Agron. 503 Principles and Practices of Weed Management 2+1  Sem.II

Agron. 504 Principles and Practices of Water Management 2+1  Sem. I

Agron. 505 Field Plot Techniques 2+1  Sem.II

Agron. 506 Agronomy of Major Cereals and Pulses 2+1  Sem.II
Origin, history, area, production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of kharif and rabi cereals and pulses (rice, maize, sorghum, millets, wheat, barley), important grain legumes (pigeonpea, mungbean, urdbean, chickpea and lentil).
Practical: Phenological studies at different growth stages of crop. Estimation of crop yield on the basis of yield attributes; Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; Working out growth indices of prominent intercropping systems of different crops; Estimation of protein content in pulses; Planning and layout of field experiments; Intercultural operations in different crops; Determination of cost of cultivation of different crops; Working out harvest index of various crops; Study of seed production techniques in various crops; Visit of field experiments.
Agron. 507 Agronomy of Oilseed, Fibre and Sugar Crops 2+1 Sem.I
Origin and history, area and production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of kharif and rabi oilseed crops (Groundnut, sesame, castor, sunflower, soybean, rapeseed and mustard, linseed, etc.), fibre crops (Cotton, jute, sunhemp etc.) and sugar crops (Sugar-beet and sugarcane etc.). Practical: Planning and layout of field experiments. Cultivation of sugarcane crop and estimation of its quality parameters. Intercultural operations in different crops; Cotton seed treatment; Working out growth indices of prominent intercropping systems; Judging of physiological maturity in different crops and working out harvest index; Working out cost of cultivation of different crops; Estimation of crop yield on the basis of yield attributes; Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; Determination of oil content in oilseeds and computation of oil yield; Estimation of quality of fibre of different fibre crops; Study of seed production techniques in various crops; Visit of field experiments.

Agron. 508 Agronomy of Medicinal, Aromatic and Under-utilized Crops 2+1 Sem.I
Importance of medicinal, aromatic, plantation and under-utilized crops in national economy and their classification. Description, distribution, climate, soil requirements, cultural practices, processing and important constituents/quality of medicinal, aromatic, plantation and under-utilized crops, viz. Aloe, Satavar, Stevia, Safed musli, Kalmegh, Asaphoetida, Amla, Bael, Vanilla, Isabgol, Mentha, Basil, Lemongrass, Citronella, Palmarosa, Rose, Patchuli, Geranium, Rice bean, Lathyrus, Sesbania, Clusterbean, French bean, Celery, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco. Practical: Identification of crops based on morphological and seed characteristics; Raising of herbarium of medicinal, aromatic and under-utilized plants; Quality characters in medicinal and aromatic plants; Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.

Agron. 509 Agronomy of Fodder and Forage Crops 2+1 Sem.II
Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like maize, bajra, cowpea, oats, barley, berseem, senji, lucerne etc. and forage crops like, napier grass, panicum, lasiuras, cenchrus etc. Year-round fodder production and management, preservation and utilization of forage and pasture crops. Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage. Use of physical and chemical enrichments and biological methods for improving nutrition. Value addition of poor quality fodder. Economics of forage cultivation uses and seed production techniques. Practical: Farm operations in raising fodder crops; Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops; Anti-quality components like HCN in sorghum and such factors in other crops; Hay and silage making and economics of their preparation.

Agron. 510 Cropping Systems and Organic Farming 3+0 Sem. II

Agron. 511 Dryland Farming and Watershed Management 2+1 Sem. II
Definition, concept and characteristics of dry land farming. Dry land versus rainfed farming. Significance

Practical: Seed treatment, seed germination and crop establishment in relation to soil moisture contents, moisture stress effects and recovery behaviour of important crops, estimation of moisture index and aridity index; spray of anti-transpirants and their effect on crops, collection and interpretation of data for water balance equations, water use efficiency, preparation of crop plans for different drought conditions. Study of field experiments relevant to dryland farming, visit to dryland and soil conservation research stations and watershed projects.

Agron. 512 Conservation Agriculture 2+0 Sem. II
Conservation agriculture definition, status and prospects. Its role towards natural resources management and sustainability concerns. Concept of conservation agriculture and their fulfillment using tillage and crop residue management, efficient cropping systems, water and nutrients management, and integrated pest management. Relevance of conservation agriculture under changing climatic conditions. Impact of conservation agriculture on soil health and crop productivity. Conservation agriculture under rainfed / dry land farming.

Agron. 601 Advanced Trends in Agronomy 2+0 Sem. I

Agron. 602 Advanced Crop Ecology 2+0 Sem.I

Agron. 603 Advanced Irrigation Management 2+0 Sem.II

**Agron. 604 Advanced Weed Management** 2+0 Sem.II


**Agron. 605 Advanced Crop Growth and Productivity** 2+0 Sem.I

**Agron. 606 Integrated Farming Systems for Sustainable Agriculture** 2+0 Sem. II
Farming systems- concept, classification of farming systems according to type of rotation, intensity of rotation, degree of commercialization, water supply, enterprises. Concept of sustainability in farming systems, efficient farming systems, natural resources - identification and management. Production potential of different components of farming systems; interaction and mechanism of different production factors, stability in different systems through research. Eco-physiological approaches to intercropping. Simulation models for intercropping, soil nutrient in intercropping, preparation of different farming system models. Evaluation of different farming systems. New concepts and approaches of farming systems and cropping systems and organic farming, case studies on different farming systems. Role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system for sustainable agriculture.

**Agron. 607 Stress Crop Production** 2+0 Sem. I
Stress and strain terminology, nature and stress injury and resistance, causes of stress. Low and high temperature stress- freezing, heat 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. Water deficit 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. Excess water and salt stress, its effects on crop plants and practical ways to overcome these through soil and crop manipulations. Mechanical impedance of soil and its impact on plant growth, measures to overcome soil mechanical impedance. 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. 591 Seminar**

**Agron. 600 Master's Research**

**Agron. 700 Ph.D. Research**
ENTOMOLOGY

PROGRAMMES

1. M.Sc.
2. Ph.D.

COURSE REQUIREMENTS

M.Sc.
Field of Specialization: Economic Entomology, Insect Ecology, Insect Physiology, Insect Taxonomy, Insect Toxicology

Required Courses: Ent.501, Ent.502, Ent.503, Ent. 504, Ent.505

Supporting Courses: Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields: Biochemistry, Biotechnology, Chemistry, Nematology, Plant Breeding & Genetics, Plant Pathology or any other as approved by Dean, Postgraduate Studies

Deficiency Courses for students with elective other than Crop Protection: 9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.
Field of Specialization: Economic Entomology, Insect Ecology, Insect Physiology, Insect Taxonomy, Insect Toxicology

Required Courses: Ent.601, Ent.602, Ent.603

Supporting Courses: Courses from subject matter fields (other than minor) relating to area of special interest and research problem.

Minor Fields: Biochemistry, Biotechnology, Chemistry, Nematology, Plant Breeding & Genetics, Plant Pathology, or any other as approved by Dean, Postgraduate Studies

Deficiency Courses for students with M.Sc. (Agri.) in a discipline other than Entomology: Ent.501, Ent.502, Ent.503, Ent.504, Ent.505, and other courses as recommended by Student's Advisory Committee
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Ent. 91/Pl.Path. 91 Plant Protection-I  2+1  Sem.I
(In collaboration with Deptt. of Plant Pathology)
Importance of insects in agriculture; feeding behaviour; identification and losses caused to different crops; methods of insect-pest management; plant diseases; important groups of plant pathogens: their characteristics; symptoms and management; plant clinic; importance and requirements.
Practical: Identification of important agricultural insect-pests and pathogens; familiarization of plant protection equipment; seed treatment and spraying.

Ent. 201 Introductory Entomology  2+1  Sem. I
Practical: Morphology and anatomy of Ak grasshopper. Different types of antennae, mouth parts, legs and wings. Types of larvae and pupae. Study of various insect orders and sub orders. Collection and preservation of insects.

Ent. 204 Fundamentals of Insect Morphology and Systematics  2+1  Sem. I

Ent. 205 Insect Ecology and Integrated Pest Management  2+1  Sem. II
Identification of common phytophagous mites, rodent, bird pests and their damage. Other beneficial insects - pollinators, weed killers and scavengers.

**Ent. 302 Insect Pests of Crops and Stored Grains**
2+1 Sem. I

Distribution, biology, symptoms of damage and management strategies of insect pests of rice, sorghum, maize, cotton, groundnut, sugarcane, ragi (Eleusine coracana), wheat, sunhemp, pulses, castor, safflower, sunflower, mustard, brinjal, bhindi, tomato, cruciferous and cucurbitaceous vegetables, potato, sweet potato, chillies, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, onion, coriander, garlic, ginger, ornamental plants and stored grain insect pests.

Practical: Identification of insect pests, their damage symptoms and management of rice, sorghum, maize, wheat, sugarcane, cotton, pulses, solanaceous, malvaceous, cruciferous and cucurbitaceous vegetables, chilli, mango, citrus, sapota and stored grains.

**Ent. 303 Household and Kitchen Garden Entomology**
1+1 Sem. II
(For students of College of Home Science)

Introduction to insects. Principles and methods of pest control. Safe handling of pesticides. Major pests (including mites, birds and rats) of kitchen garden, household, stored foodstuffs and live-stock, their bionomics and control. Introduction to beekeeping and sericulture.


**Undergraduate Elective/M.Sc. Supporting/Minor Courses**

**Ent. 433 Apiculture**
1+2 Sem. I


**Ent. 434 Biocontrol and Integrated Pest Management**
2+2 Sem. I

History and concept of biological control, different groups of biological control agents and biopesticides-microbials (parasitoids and predators), microbials (bacteria, viruses, fungi, protozoa and nematodes) and botanical- neem, pyrethrum, nicotine, rotenone and others, their use in pest management along with advantages and limitations. Methods of mass production for each of these groups. National and international agencies dealing with biological control. IPM-history, definition and concept. Concept of economic threshold. Pest monitoring and surveillance. Different tools of IPM including physical, mechanical, cultural, biological (parasite and predators, microbial agents), host plant resistance, botanical, chemical, biorational and biotechnological approaches. Integration of different IPM tactics. Decision making systems. Potential of IPM, its implementation and constraints. Successful example in IPM.

Practical: Identification of important groups of parasitoids, predators and microbial control agents. Laboratory multiplication of parasitoids, predators and microbial control agents. Determination of economic threshold.
levels. Demonstration of cultural and mechanical control measures of different pests. Use of pheromones, colour, sticky and light traps for monitoring and surveillance of pests. Study of IPM module in cotton, rice, sugarcane, maize, fruits and vegetables.

**Ent. 435 Pesticides and Plant Protection Equipment**


**Postgraduate Courses**

**Ent. 501 Insect Morphology and Systematics**


**Ent. 502 Insect Anatomy and Physiology**


**Ent. 503 Classification of Insects**

History of insect classification and its importance. Introduction to phylogeny of insects. Classification of Superclass Hexapoda including all the classes with special emphasis on Class Insecta. Distinguishing morphological characters alongwith the habits and habitats of insects belonging to economically important families of all the orders of Class Insecta. Practical: Collection and preservation of insects. Identification of insects upto family level. Field visits to collect insects of different orders.

**Ent. 504 Insect Ecology**


Ent. 505 Toxicology of Insecticides 2+1 Sem. II

Practical: Insecticide formulation and mixtures, quality control of pesticide formulations. Working out doses and concentrations of pesticides for laboratory and field evaluation for their bioefficacy, bioassay techniques, probit analysis, evaluation of insecticide toxicity and joint action. Toxicity to beneficial insects.
Preparation of working standard solutions of pesticides, Sampling, extraction, clean-up and estimation of insecticide residues by various methods, calculations and interpretation of data, visit to toxicology laboratories, good laboratory practices.

Ent. 506 Biological Control of Insect Pests 2+1 Sem. I


Ent. 507 Plant Resistance to Insects 2+1 Sem. II


Ent. 508 Integrated Pest Management 2+1 Sem. I

Ent. 509/Pl.Path.509/Nem. 509 Molecular Approaches in Plant Protection 2+1 Sem.II

Ent.510/Pl.Path.510/ Nem. 510 Quarantine in Plant Protection 2+0 Sem.II

Ent.511 Insect Vectors of Plant Pathogens 2+1 Sem.II

Ent. 512 Commercial Entomology 2+1 Sem.II

Ent. 513 Storage Entomology  2+1  Sem. II


Ent. 514 General Acarology  1+1  Sem.II
History of acarology. Importance of mites and ticks as a group. Introduction to morphology and biology of mites and ticks. Broad classification of major orders and important families of Acari including diagnostic characteristics. Economic importance of mites. Seasonal occurrence and nature of damage of mite pests on different crops. Mite pests in polyhouses, stored products and honey bees. Management of mites using acaricides and natural enemies. Culturing of phytophagous, predatory and parasitic mites.

Practical: Collection and extraction of mites from different habitats. Preparation of mounting media and slide mounts. External morphology of mites. Identification of mites up to family level using keys. Studying different rearing techniques for mites.

Ent. 601 Advanced Insect Systematics  2+0  Sem.II

Ent. 602 Advanced Insect Physiology  2+0  Sem.II

Ent. 603 Advanced Insect Pest Management  2+0  Sem.II
Database management and computer programming, simulation techniques and system analysis and modelling. Case histories of national and international programmes, their implementation, adoption and criticisms, global trade and risk of invasive pests. Advances in application of behavior modifying chemicals, insect growth regulators, genetic engineering and other biotechnological strategies for management of insect pests. Strategies for pesticide resistance management and resurgence in insects. Scope and limitations of bio-intensive and ecological based IPM programmes. Applications of IPM to farmers’ real time situations. Dynamism of IPM under changing cropping systems and climate; insect pest management under protected cultivation. Advances in pesticide application technology.

Ent. 604 Advanced Insect Ecology  2+0  Sem. I
Influence of changing environment and pest populations. Life-system approach to the study of insect

Ent.605 Advanced Biological Control 2+0 Sem.II
(Pre-requisite Ent.506)

Ent. 606 Advanced Insecticide Toxicology 2+1 Sem. I
Practical: Sampling, extraction, clean-up and estimation of insecticide residues by various methods, calculations and interpretation of data, biochemical and biological techniques for detection on insecticides resistance in insects.

Ent. 607 Advanced Host Plant Resistance 2+0 Sem.II
(Pre-requisite Ent.507)

Ent. 608 Insect Behaviour 2+0 Sem. II
Evolution and inheritance of insect behaviour. Innate and learned behaviour patterns. Orientation - forms of primary and secondary orientation including taxes and kinesis. Responses to environmental stimuli; role of visual, olfactory and auditory signals. Biological functions of insect behaviour such as locomotion, feeding, host selection and location, escape, defense, reproduction, dispersal and migration. Activity rhythms and biological clocks. Genetic and hormonal control of insect behaviour. Regulation of insect population through behavioural manipulations. Inter- and intra-specific communication. Insect societies. Nest founding and construction, brood care, defense and caste determination in social insects.

Ent.591 Seminar
Ent. 600 Master's Research
Ent.700 Ph.D. Research
EXTENSION EDUCATION

PROGRAMMES
1. M.Sc.
2. Ph.D.
3. B.Ed.

COURSE REQUIREMENTS

M.Sc.
Field of Specialization: Communication and Adoption of Innovations, Farmers' Training and Education, Extension Administration.

Required Courses: Ext.501, Ext.502, Ext.503, Ext.504, Ext.505, Ext.506

Supporting Courses: Stat.421, Stat.522, PGS 501 and other courses from subject-matter fields (other than minor) relating to area of special interest and research problem.

Minor Fields: Any agricultural subject depending upon the student's interest and research problem.

Deficiency courses for students with elective other than Agri-Business Management, Economics and Extension Education:
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph.D.
Field of Specialization: Communication and Adoption of Innovations, Farmers' Training and Education, Extension Administration.

Required Courses: Ext.601, Ext.602, Ext.603

Supporting Courses: Stat.526 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem.

Minor Fields: Any agricultural subject depending upon the student's interest and research problem.

Deficiency courses for students with M.Sc. (Agri.) in a discipline other than Extension Education:
Ext.501, Ext.502, Ext.503, Ext.504, Ext.505, Ext.506, Stat.522 and other courses as recommended by Student's Advisory Committee.

B.Ed.
Compulsory courses:

Choice courses
i) Teaching subjects (one out of three streams to be chosen by each student)
   (i) Agriculture Edu.461 Edu.462/463
   (ii) Agromechanics Edu.464 Edu.467
   (iii) Home Science Edu.465 Edu.466
   (iv) Fashion Designing Edu.465 Edu.472

ii) Area of special interest (one out of two areas to be chosen by each student)
   (i) Vocational Guidance and Counseling Edu.468 Edu.469
   (ii) Curriculum and Text Books Development Edu.470 Edu.471
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Ext. 91 Extension - I 2+0 Sem.II
Introduction; meaning and importance of rural development, its basic objectives. Integrated Rural Development Programme, its working, objectives and achievements. Various schemes of IRDP for strengthening the infrastructural base in the villages. Role of community development and voluntary agencies in rural development. Role of Panchayati Raj Institutions in agriculture and rural development. Past strategies and current approaches to rural development.

Ext.101 Dimensions of Agricultural Extension 1+1 Sem.II

Ext.201 Fundamentals of Rural Sociology and Educational Psychology 2+0 Sem.I

Ext.202 Extension Methodologies and Communication Skills for Transfer of Technology 1+1 Sem. I & II
Practical : Simulated exercises on communication. Developing a project based on identified problems in a selected village. Organization of group discussion and method demonstration. Visit to Krishi Vigyan Kendra. Planning and script writing for radio and television talks. Planning and preparation of visual aids and agricultural information materials. Handling of public address system.

Ext. 302 Communication Skills 0+2 Sem.II
Development of oral communication skills for individual, group and mass contact under simulated and real life conditions. Developing good listening skills and practice in delivering radio and TV talks under simulated conditions. Practice in writing popular farm literature- articles, leaflets, bulletins, folders, newspapers and news stories etc. Practice in identification and use of traditional communication media.
Undergraduate Elective/M.Sc. Supporting/Minor Courses
Ext.433 Visual and Graphic Communication 1+1 Sem.I

Ext.434 Communication and Information Technology 2+1 Sem.I
Practical: Studying problems faced by farmers at Agri-clinic and analyzing communication problems of extension personnel. Use of different extension teaching methods in field and simulated conditions. Practice in planning and conducting video-conferencing. Visit to information kiosks. Identifying problems in agriculture information management system.

Ext.435 Behavioural Skills for Human Resource Development 2+0 Sem.I

RAWE 499 Rural Agricultural Work Experience 0+20 Sem. II
After the completion of course work, the students of B.Sc. Agri. (Hons.) will receive training under the compulsory RAWE programme for 20 weeks. The students will attend the one day orientation each in electives: (a) Soils, Agronomy and Agro-forestry; (b) Crop Protection and Economics Agri-business and Extension Management. (c) Horticulture; (d) Plant Breeding, Genetics and Biotechnology; and (e) Post Harvest Technology and Value Addition. The students will attend two weeks Village Attachment Training. Further, they will undergo 12 weeks on-campus training in: (a) Bee-keeping; (b) Mushroom cultivation; (c) Plant Clinic Activities of Farmers' Service Centre, Communication Centre and Kairon Kisan Ghar; (d) Seed/Nursery Production; (e) Food Processing & Preservation; and (f) Biotechnological Tools in Crop Improvement. Students will also attend 4-week off-campus training in different elective-wise activities. During the last week of the training, the students will submit the report whose evaluation will be done by the concerned teachers on the basis of their performance in orientation, village attachment, on and off-campus training.

Postgraduate Courses
Ext. 501 Development Perspectives of Extension Education 1+1 Sem.I
Objectives, principles and philosophy of extension education. Adult education and distance education. Pioneering extension efforts and their implications in Indian agricultural extension system. Analysis

Practical: Studying on-going rural development programmes. Visits to KVK, NGO and extension centers of State Agricultural University and state development departments to study their objectives, organizational set up and activities. Report preparation and presentation.

Ext. 502/HECM 502 Development Communication and Information Management 2+1 Sem.II
Communication-concept, meaning, importance, models, theories and types. Communication delicity, credibility, empathy, feedback and factors affecting communication process. Communication skills. Characteristics and role of key communicators in development. Expert system in selected enterprises. Role of ICT in communication. Social networks and development. Effective oral communication, public speaking, non-verbal communication, writing skills and soft skills. Participative communication-meaning, importance, process and determinants. Development communication-concept, nature and significance. Recent advances in communication-print and electronic, internet, e-mail, fax, mobile, interactive video and teleconferencing, computer and computer networking (PAN, LAN, CAN, MAN, WAN), AGRINET, e-Governance.

Practical: Exercises in oral and written communication. Planning and use of different communication approaches. Practical hands on experience in recent advances in print and electronic media.

Ext.503/HECM 503 Participatory Programme Management 1+1 Sem.II
Conceptual framework of extension programme. Planning - key concepts and importance in planned change. Participatory planning - concept, importance, process. Techniques of participatory planning-RRA, PRA and PLA and their application in extension. Approaches of participatory planning -cooperative, democratic, bottom up and down. Project management techniques - PERT, CPM, SWOT analysis, obtaining technical and monetary support from GOs and NGOs. Importance and ways of people's participation in programme planning. Concept and formation of farmers and women SHGs. Implementation and evaluation - concept, importance and techniques.


Ext. 504 Diffusion and Adoption of Innovations 1+1 Sem.I

Practical: Case studies in individual and community adoption process. Content analysis of adoption studies. Identification of adopter categories of a selected technology. Studying attributes of current farm technologies. Identification of opinion leaders. Sources of information at different stages of adoption. Studying factors affecting rate of adoption. Presentation of reports on adoption and diffusion of innovations.

Ext.505/Econ.506/Soc.506/HECM 501 Research Methodology for Social Sciences 2+1 Sem.I
Importance and scope of research in social sciences. Concept and characteristics of social research. Types of research. Fundamental vs Applied. Concept of researchable problem - research rioritization,


Ext. 506 Human Resource Development 2+1 Sem.II

Practical: Visits to different training organizations to review their ongoing activities and facilities. Analysis of training methods used for imparting training to farmers and extension personnel. Evaluation of a training programme. Studying human resource development in an organization in terms of performance, organizational development, employee's welfare and improving quality of work life and human resource information.

Ext.507 Entrepreneurship Development and Management in Extension 2+1 Sem.II


Ext.508 Perspectives of Distance Education 2+0 Sem.I
information and educational technologies in distance education. Development of course, course material and management of resources. Video classroom strategy in distance education. Strategies for maximizing services to students and programme evaluation.

**Ext. 509 Market Led Extension Management** 1+1 Sem.II
(In collaboration with Deptt. of Economics and Sociology, COBSc.&H)
Practical: Identification and analysis of different marketing sources for agricultural commodities. Developing strategy for an effective market intelligence system and marketing plan to suit rural situation. Visits to APEDA and Apni Mandi to study their processes and procedures related to market-led extension.

**Ext. 510 Visual Communication** 1+1 Sem.I

**Ext.511 / HECM 506 Gender Sensitization for Empowerment** 2+0 Sem.I
Gender sensitization-meaning, need and importance of empowering women. Gender in community diversity and its implication for empowerment. Gender perspectives in development of women, social characteristics, desegregated roles, responsibilities, resources, constraints and opportunities. Economical, educational and anthropological parameters in gender perspectives. Gender dimensions and methodologies for empowerment. Gender analysis framework-context, activities, resources, tools and programme action profile. Training aids for gender sensitization. Empowerment through gender specific technologies, household technology interface. Socio-cultural interface and women as consumer of technologies. Gender issues and development-health and nutrition, violence, governance, educational media.

**Ext. 601 Advances in Agricultural Extension** 2+0 Sem.II

**Ext. 602/HECM 602 Scaling Techniques for Behavioural Research** 2+1 Sem.II
Meaning, types, principles and steps of scaling. Techniques of attitude scale construction - Paired comparison, Equal appearing intervals, Successive intervals, Summated ratings, Scalogram


Ext.603 Advances in Training Technology 3+0 Sem.I

Ext.604 Organizational Development 2+0 Sem.II

Ext.605 Advanced Instructional Technology 2+0 Sem.I

Ext.606 Theory Construction in Social Sciences 2+0 Sem.I

Ext.607 Transfer of Technology in Agriculture 2+0 Sem.II
Transfer of technology (TOT) and transfer of technology systems. Knowledge generating system. Knowledge disseminating and consuming system. Input supplying agencies system. Appropriateness of communication media in the system of technology transfer. New communication strategy for transfer and adoption of agricultural technology. Extension training in transfer of technology.
Analysis of constraints in transfer of technology. Agencies or departments involved in TOT. Role of extension professionals in TOT. Attributes of technology in relation to TOT process. TOT to resource poor farmers. Role of key communicators or local leaders in TOT. Private and public partnership in TOT. TOT system in USA, Asian and European countries.

Ext.608/HECM 606 Advanced Media Management  2+1  Sem.I
(In collaboration with Deptt. of Agril. Journalism, Languages & Culture, COBSc.&H)
Practical: Visit to print, electronic and new media organizations to understand the designing, media development, organizational management, functions, problems etc.

Ext.591 Seminar
Ext.600 Master's Research
Ext.700 Ph.D. Research

B.Ed. Courses

Edu.451 Structure of Modern Indian Education  3+0  Sem.II
Structure, problems and future trends of modern Indian Education with special reference to pre-school, primary, secondary, higher education and teachers' training. Various educational acts and reports of educational commissions since independence. Orientation towards vocationalization and correspondence education.

Edu.452 Philosophy and Sociology of Education  3+0  Sem.I

Edu.453 Educational Psychology  3+0  Sem.I

Edu.454 Methods and Innovations in Teaching  2+0  Sem.I
Technological and methodological innovations in teaching-methods, techniques and devices used in teaching. A functional treatment of traditional and modern methods, techniques and devices for teaching, such as Dalton Plan, observation heuristic, brainstorming, group tutorial, project, discussion, programmed
instruction, individualised instruction, playway, excursion, role playing. Preparation of lesson plans for teaching. Use of computers in school teaching.

**Edu.455 Audio-Visual Aids in Education**

1+2 Sem.I

Meaning, scope and importance of audio-visual aids in teaching-learning situations. Classification, selection and use of audio-visual aids.

Practical: Preparation and use of various projected and graphic aids for classroom teaching.

**Edu.456 Practicum**

0+6 Sem.II

(Practice in School teaching in any two of the prescribed subjects)

**Edu.457 Educational Evaluation and Statistics**

2+1 Sem.II


Practical: Practice in developing model tests and use of scoring techniques. Computation of mean variance and regression coefficients.

**Edu.458 School Organization**

3+0 Sem.II

Principles and practices of school organization. Special emphasis on organization of school education in Punjab. Economic implications of school education. Problems and techniques in school campus planning, operations and maintenance including landscaping and beautification. Organization and handling of school library. Organization of curricular and co-curricular activities. Time-table planning and school discipline. School and community relationships. Services for students' health and hygiene. Formation of school budget and maintenance of accounts.

**Edu.459 Educational Games and Hobbies**

0+1 Sem.II

Importance and scope of educational games and hobbies in teaching-learning situations. Preparation and practice in the handling of various educational games and hobbies applicable at the school level.

**Edu.460 Special Topics in Education**

0+2 Sem.II

Each student will be required to make a systematic study and write a paper for classroom presentation of such topics as effective methods of teaching vocational skills, problems of testing school children vis-a-vis agriculture, home science, agro mechanics and other related subjects, curriculum development, preparation of instructional materials, educational surveys and data collection, vocational guidance and counseling.

**Edu.461 Methods of Teaching Agriculture**

2+1 Sem.I


Practical: Preparation of model lesson plans and practice in effective methods of teaching agriculture in classroom and outside-class situations.

**Edu.462 Methods of Teaching Horticulture**

2+1 Sem.I

Practical: Preparation of model lesson plans including landscaping, vegetables and fruits and practice in effective methods of teaching horticulture in classroom and outside-class situations.

**Edu.463 Methods of Teaching Animal Science** 2+1 Sem.I
Practical: Preparation of model lesson plans and practice in effective methods of teaching animal sciences in classroom and outside-class situations.

**Edu.464 Methods of Teaching Agro-Mechanics** 2+1 Sem.I
Practical: Preparation of model lesson plans and practice in effective methods of teaching agro-mechanics in classroom and outside-class situations.

**Edu.465 Methods of Teaching Home Science** 2+1 Sem.I
Practical: Preparation of model lesson plans and practice in effective methods of teaching home science in classroom situation.

**Edu.466 Methods of Teaching Biology** 2+1 Sem.I
Place of Biology in school curriculum. Methods and problems connected with teaching of Biology. Teaching and abilities to internalize basic concepts. Factors affecting the acquisition of skills. Steps in teaching skills at school level. Micro-teaching in Biology. Management of laboratory units.
Practical: Preparation of model lesson plans and practice in effective methods of teaching Biology in a classroom situation.

**Edu.467 Methods of Teaching Physics and Chemistry** 2+1 Sem.I
Practical: Preparation of model lesson plans and practice in effective methods of teaching physics and chemistry.

**Edu.468 Vocational Aptitude Testing** 2+1 Sem.II
Concept and nature of aptitude and related terms such as attitude, aspiration and interest. Functions of aptitude in the development of vocational talents and abilities. Role of aptitude in vocational guidance and counseling. Major types of aptitude tests- intelligence, academic, manual dexterity, mechanical and artistic ability. Specific multiple aptitude tests, principles relating to construction, scoring and interpretation of aptitude tests.
Practical: Group and individual exercises in the development, administration and interpretation of given aptitude tests.
Edu.469 Guidance and Counseling  
3+0  Sem.II  

Edu.470 Curriculum Development  
2+1  Sem.II  
Types of curriculum approaches used at the school level. Principles of curriculum development. Structuring model curricula in agriculture, agro-mechanics, home science and other vocational subjects. Practical: Group exercises in analyzing educational needs, stating educational objectives and developing a model curriculum in a given vocational subject.

Edu.471 Preparation of Manuals and Text Books  
1+2  Sem.I  

Edu.472 Methods of Teaching Fashion Designing  
2+1  Sem.I  
FLORICULTURE AND LANDSCAPING

PROGRAMMES
1. M.Sc.
2. Ph. D.

COURSE REQUIREMENTS

M.Sc.
Field of Specialization: Floriculture, Landscaping
Required Courses: Flori. 501, Flori. 502, Flori. 503, Flori. 504
Supporting Courses: Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to the area of special interest and research problem.
Minor Fields: Plant Breeding & Genetics, Biotechnology, Horticulture, Soil Science, Botany or any other as approved by Dean, Postgraduate Studies.
Deficiency courses for students with elective other than Horticulture
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph.D.
Field of Specialization: Floriculture, Landscaping
Required Courses: Flori. 601, Flori. 602, Flori. 603
Supporting Courses: Courses from subject matter fields (other than minor) relating to area of special interest and research problem
Minor Fields: Plant Breeding & Genetics, Biotechnology, Horticulture, Soil Science, Botany or any other as approved by Dean, Postgraduate Studies.
Deficiency courses for students with M. Sc. (Agri.) courses as recommended by Student's Advisory Committee.
in a discipline other than Floriculture and Landscaping
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Flori. 301 Flower Cultivation and Landscape Gardening  1+1  Sem.II

Undergraduate Elective/M.Sc. Supporting/Minor courses

Flori. 433 Commercial Floriculture and Landscaping  2+1  Sem.I

Postgraduate Courses

Flori. 501 Production Technology of Flowers  3+1  Sem.I
Practical: Description of varieties. Propagation techniques. Mist chamber operation. Training and pruning techniques. Practices in manuring, drip and fertigation, foliar nutrition, growth regulator application,

Flori. 502 Breeding of Flower Crops and Ornamental Plants  2+1  Sem.II


Flori. 503 Landscaping and Ornamental Gardening  2+1  Sem.I


Flori. 504 Landscape Designs (Pre-requisite: Flori. 503)  2+2  Sem.II

Practical: Site analysis of various landscape projects. Use of drawing scale, lettering, plotting, reading and interpretation of maps on different scales. Preparation of landscape designs of various types of buildings, roads, parks, sport centers, picnic spots, and camping grounds. Display of plants for interior decoration. Preparation of cost estimates for landscaping and maintenance. Study tours. Introduction to CAD.

Flori. 505 Protected Floriculture (Collaboration: Deptt. of Soil and Water Engineering) 2+1  Sem.II

Flori. 506 Value Addition in Flowers 2+1 Sem.I

Flori. 507 Turfing and Turf Management 2+1 Sem.I

Flori. 508 CAD for Outdoor and Indoor Landscaping 1+2 Sem.I

Flori. 601 Advances in Flower Production Technology 3+0 Sem.II
Flori. 602 Advances in Breeding of Flower Crops 3+0 Sem. I

Flori. 603 Advances in Landscape Architecture 1+2 Sem.I

Flori. 604 Advances in Pre and Post-harvest Management of Ornamentals 3+0 Sem.II

Flori. 605 Advances in Nursery Production and Management 2+0 Sem.I
Flori. 606 Advances in Protected and Precision Floriculture 2+0 Sem.II

Flori. 607 Planning and Management of Parks 2+0 Sem.II
Recreational parks - history, importance, scope and their role in outdoor recreation and nature conservation. Biotic regions of the world. Types of distribution of vegetation in India. Bio-aesthetic planning, Planning and designing of Botanical gardens, amusement and zoological parks. Maintenance of historical and archeological sites, recreational gardens, Wet lands, National parks, and wild life sanctuaries.

Flori. 591 Seminar
Flori. 600 Master's Research
Flori. 700 Ph.D. Research
FOOD SCIENCE AND TECHNOLOGY

PROGRAMMES
1. B.Tech. Food Technology
2. M.Sc.
3. Ph.D.

COURSE REQUIREMENTS

M.Sc.
Field of Specialization
Cereal Technology, Fruit and Vegetable Technology, Dairy Technology, Egg and Meat Technology

Required Courses
FT 501, FT 502, FT 503, FT 504, FT 505, FT 506

Supporting Courses
Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to the area of special interest and research problem

Minor Fields
Microbiology, Biochemistry, Processing and Food Engineering, Food and Nutrition or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students with elective field other than Post Harvest Technology and Value Addition
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.
Field of Specialization
Cereal Technology, Fruit and Vegetable Technology, Dairy Technology, Egg and Meat Technology

Required Courses
FT 601, FT 602, FT 603, FT 604

Supporting Courses
Courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Microbiology, Biochemistry, Processing and Food Engineering, Food and Nutrition or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for Students with M.Sc. (Agri.) in a discipline other than Food Science and Technology
FT 501, FT 502, FT 503, FT 504, FT 505, FT 506 and other courses as recommended by Student's Advisory Committee
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

FT 101 Food Production Trends and Programmes  2+0  Sem.I & II
Global food demand and supply. Technological advances to meet the needs, future priorities. Food production and availability of processed, semi processed, ready-to-eat and fast foods. Food characteristics, nutritional significance of major food groups. Consumption trends. New food product development programmes for more availability to increasing population, their prospects - merits and drawbacks. National and international trends and programmes in food handling, processing and marketing. Food losses - factors affecting, programmes and strategies to eliminate the losses. Status of food industry in India and abroad.

FT 102 Principles of Food Processing and Preservation  2+1  Sem. II

FT 201 Technology of Fish and Marine Foods  1+1  Sem. I

FT 202 Food Quality  1+1  Sem.I
Food quality and its role in food industry. Physical quality attributes such as colour, size, shape, viscosity, consistency, flavours, their role in food quality and methods of assessment. Chemical and microbiological quality of food. Sensory quality evaluation - panel screening, selection and methods. Sensory and instrumental analysis in quality control. Sampling and specification of raw material and finished products. Food grades and standards.
Practical: Techniques for quality assessment of fruits, vegetables, cereals, dairy products, meat, poultry, fish, marine, raw / processed products. Sensory evaluation of products. Visit to food industry

FT 203 Food Packaging  2+1  Sem.II
Importance and scope of packaging. Packaging requirements, functions and hazards acting on package during transportation. Labelling laws. Packaging Materials: classification of packages-corrugated and paper board boxes, glass, metal, aluminium and plastic as package material. Classification of polymers, their properties and uses. Lamination types and, properties. Coating on paper and films. Types and methods of coating. Aseptic packaging- process, comparison with conventional packaging, system and materials
used for aseptic packaging. Machineries used in packaging of foods. Packaging of specific foods. Mechanical and functional tests on packages.


**FT 204 Technology of Extruded Food Products 2+1 Sem. II**

Introduction to food extrusion technology - importance, principles and methods. Components of extruder, types of extruders - single screw, twin screw, co-rotating and counter rotating etc. Classification of extruders based on shear, cooking, process description - feeding, compression and cooking zones, independent and dependent variables. Raw materials - structure forming, filling materials, plasticizers/lubricants, nucleating, flavouring and colouring agents. Effect of extrusion on food components and food properties. Applications of extrusion - breakfast cereals, snacks, co-extruded foods, third generation snacks, texturized vegetable proteins (TVP) etc. Quality evaluation and packaging requirements.

Practical: Parts and types of extruders, preparation of breakfast cereals, snacks, co-extruded products, texturized vegetable proteins (TVP). Demonstration: effects of extrusion variables on process and product quality.

**FT 302 Introduction to Food Science and Post Harvest Value Addition 1+1 Sem. I & II**


Practical: Quality assessment of cereals, fruits, vegetables, milk, egg, meat and poultry. Value added products from cereals, fruits, vegetables, milk, egg and meat. Visit to local processing units.

**FT 303 Food Additives 2+1 Sem.I**


**FT 304 Food Industry By-products 1+1 Sem.I**

Potential and prospects of food industry waste by-products. By-products of cereals, legumes, oil seeds, dairy, fruits and vegetables, meat, poultry and eggs, fish, plantation crops, spices, fermentation, sugar and bakery industries. Utilization of food industry waste by-products.


**FT 305 Food Safety, Laws and Regulations 2+1 Sem.II**

Indian Standards. CODEX STANDARDS for cereals, pulses, fruits, vegetables, meat and poultry products. Recommended International Code of Hygiene for various products.

Practical: Examination of Cereals and pulses from a godown and market shop in relation to FPO and BIS specifications. Estimation of toxins in food samples. Examination of various food products as per food standards. Visit to quality control laboratory and food processing industry.

FT 306 Speciality Foods 1+1 Sem. I & II


Practical: Preparation of speciality foods from plant and animal kingdom sources based on functionality, convenience, cost, and nutritive value. Assessment of by-products for preparation of value added speciality food. Isolation of nutraceuticals and their utilization in foods. Visit to organic farm and speciality food industry.

FT 307 Technology of Food Beverages 1+1 Sem. II


Practical: Sampling of water for testing. Quality tests of water - physical, chemical, microbiological. Preparation, packaging and testing of carbonated non-alcoholic beverages. Quality testing of tea and its beverage. Quality testing of coffee and its beverage. Preparation, packaging and testing of wine.

FT 401 Quality Assurance and Certification 2+1 Sem.II


FT 402 Confectionery and Bakery Technology 2+1 Sem.I


Practical: Physical properties of sugar. Determination of moisture and reducing sugars in sugar. Preparation of fondant, high boiled candy, toffee, butter scotch, pulled sugar, jellies and gums. Visit to confectionary
industry. Preparation of cakes, biscuits, cookies, crackers, buns, pastry, pizza, vermicelli, noodles etc.
Shelf life and quality of bakery products.

**FT 403 Technology of Legumes and Oilseeds**  
2+1  Sem.I


**FT 404 Technology of Plantation Crops and Spices**  
1+1  Sem.I


**B. Tech./ Undergraduate Elective /M.Sc. Supporting / Minor Courses**

**FT 433 Fruit and Vegetable Technology**  
2+1  Sem.I

Present status and scope of Fruit & Vegetable Industry in India. Principles and preservation of fruits and vegetables by thermal processing, low temperature, chemicals, irradiation, salt, sugar and high pressure. Preparation of jams, jellies, marmalades, juices, squashes, ketchup, pickles, chutneys, wine and vinegar. Role of pectin in gel formation. Quality characteristics of fruit and vegetable products. Selection of site, design, layout, equipment, machinery and buildings. Plant sanitation. Disposal of wastes from fruit and vegetable processing plants. Project formulation and evaluation.


**FT 434 Dairy Technology**  
2+1  Sem.I


**FT 435 Cereal Technology 2+1 Sem.I**
Practical: Determination of quality characteristics of wheat, wheat flour and atta. Rice milling and parboiling. Pearling and malting of barley. Preparation of chapatties, bread, biscuits, cakes, buns, rusks, flat bread, broken wheat i.e. porridge, puffed and extruded products.

**FT 436 Egg and Meat Technology 2+1 Sem.I**

**FT 499 Industrial Training 0+20 Sem. II**
After the completion of the course work, the B. Tech. Food Technology (Hons.) students would undergo compulsory Industrial Training in food industry for the duration of one semester. The students after acceptance by the food industry will submit plan of work to the class teacher(s) within two weeks of joining. The students will be required to submit detailed project report two weeks prior to the end of the semester. The evaluation of the Industrial Training will be based on the project report submitted, industry manager’s report and oral presentation cum viva voce.

**Postgraduate Courses**

**FT 501/FN 512 Principles of Food Processing 2+1 Sem. I**
Scope of food processing and historical developments. Principles and methods of food processing and preservation - blanching, pasteurization, sterilization and UHT processing, aseptic processing, canning, extrusion, baking, roasting, frying, drying, concentration and evaporation dielectric and microwave heating, refrigeration, freezing, controlled atmosphere (CA), modified atmosphere (MA), and dehydrofreezing. Non-thermal methods - irradiation, high pressure, pulsed electric field, hurdle technology, minimal processing and membrane technology. Food fermentations, pickling, smoking and chemical preservation.

**FT 502 Food Additives and Ingredients 2+1 Sem. I**
Practical: Estimation of preservatives, sweeteners, fibre, colours, antioxidants, flavour enhancers. Functional properties of native and modified proteins, starch and lipids. Extraction of essential oil and oleoresins. Applications of additives and ingredients in foods
FT 503 Food Quality Systems and Management 2+1 Sem. II

FT 504 Enzymes in Food Processing 2+1 Sem.II
Enzymes- classification, properties, nature and mode of action. Sources and production of enzymes. Natural enzymes in foods - their significance in food processing. Commercial enzymes and their application in fruits (cell wall degrading enzymes for liquefaction, clarification, debittering, decolourization of very dark coloured juices), vegetables, milk (cheese making, whey processing), meat, poultry (tenderization) and egg, malting, brewing, baking (fungal - amylase for bread making, maltogenic - amylases for anti-staling, xylanases, pentosanases and lipases as dough conditioners, oxidases as replacers of chemical oxidants) and confectionery. Enzymes for corn syrup solids (liquefaction, saccharification, isomerization for production of high-fructose-corn-syrup), fructose and fructo-oligosaccharides. Enzyme processing for flavours. Enzymatic approach to tailor-made fats.
Practical: Assay of enzymes in raw and processed foods. Applications of commercial enzymes in food product preparation- baking, starch hydrolysis, meat tenderization, cheese making and juice clarification.

FT 505 Nutraceuticals and Health Foods 2+1 Sem. I

FT 506 Implant Training 0+1 (NC) Sem. I & II
After the completion of theory, and research work, M.Sc. students would undergo compulsory implant training in a food industry for a duration of six weeks. On completion of industrial implant training the students will be required to submit a written training report. The students will be evaluated for awarding the grade on the basis of project report, industry manager's report, oral presentation and viva-voce.

FT 507 Technology of Fruit and Vegetable Processing 2+1 Sem.I
Indian and global scenario on production and processing of fruits and vegetables. Quality requirements of raw materials for processing. Post harvest handling, grading and treatments. Storage of fruits and vegetables-controlled atmosphere (CA) and modified atmosphere (MA) storages. Physiological and enzymological aspects of juice extraction. Fruit and vegetable processing for pulp, puree and concentrates using aseptic packaging, canning, RTS fruit beverages, IQF and frozen fruits and vegetables. Technology for processed products - pickles, chutneys, sauces. Processing of fruits for candies, bars, toffees, jams and jellies, squashes, syrups, cordials, nectars, vinegar and tomato products. Dehydration of fruits and vegetables using various drying technologies. Intermediate moisture fruits and vegetables. Food ingredients and chemicals from fruits, vegetables and their wastes. Effluent treatment. Trends in health aspects related to fruits and vegetables.

FT 508 Technology of Cereals, Pulses and Oilseeds  2+1  Sem. I


FT 509 Technology of Milk and Milk Products  2+1  Sem. I


FT 510 Technology of Meat, Poultry and Fish  2+1  Sem. I


FT 511/PFE 510 Food Packaging  2+1  Sem. II


FT 601 Advances in Food Technology 2+0 Sem.II
Membrane technology- micro-filtration, ultra-filtration, nano-filtration, reverse osmosis and their applications in food industry. Supercritical fluid extraction-concept and extraction methods. Microwave and radio frequency processing-mechanism and application in food processing. Hurdle technology-concept and its applications. High Pressure processing-concept, equipments for HPP treatment, mechanism and its application. Ultrasonic processing-properties and applications. New techniques-high intensity light, pulse electric field, ohmic heating, infra red heating, inductive heating and pulsed X-rays and nanotechnology in food processing. Techniques in fortification and stability of nutrients in relation to processing. Flavour stabilization.

FT 602 Advanced Food Analysis 0+2 Sem. I
Sample preparation for food analysis. Measurement of colour, viscosity/texture and water activity of raw and processed foods. Rheological techniques and instrumentation in food. Determination of browning reaction, food additives, residues and deleterious factors in raw and processed foods. Enzymatic, Thermal and Chromatographic methods in food analysis. Microscopic, Fluorimetric and polarimetric techniques in food analysis. Application and operating parameters of spectrophotometer, AAS (Atomic absorption spectroscopy), GC (Gas chromatography), HPLC (high performance liquid chromatography), NMR (nuclear magnetic resonance), FTIR (Fourier transform infrared spectroscopy), GC-MS (gas chromatography-mass spectroscopy), LC-MS (liquid chromatography-mass spectroscopy).

FT 603 Product Design and Development 2+0 Sem.II

FT 604 Carbohydrate Technology 2+1 Sem. II
Different carbohydrates in food products such as starch, cellulose, sugars, pectin, fibres (significance in diet, isolation from natural sources, and changes therein during processing). Chemical & enzymatic modification of carbohydrates especially starches and celluloses, manufacture of maltodextrins and corn syrups, Cyclodextrins - chemistry, technology and food applications. Interactions with other food constituents and their implications; Newer carbohydrates for food applications such as xanthan, dextran, pullulan, gellan, curdlan and ?-glucans (nutraceutical and functional properties) Stabilization of food systems, simulated and low-fat foods, Fat-substitutes based on carbohydrates, Carbohydrate-based biodegradable packaging.

Practical: Isolation and assay of food carbohydrates; analysis of modified carbohydrates such as starches and celluloses; evaluating gelling abilities of different polysaccharides, their blends and the effect of food ingredients such as salts, sugars and acids; development of food products with newer carbohydrates in relevant food systems.
FT 605  Lipid Technology  2+1  Sem. I
Nutritional aspects of food lipids and their sources- omega-3 and omega-6 fatty acids and their significance, Phytosterols and their nutraceutical significance. Measurement of lipid degradation parameters during deep-fat frying and storage of foods. Flavor emulsions and their stability. Fat powders like cream, butter, cod-liver oil etc. and techniques involved such as micro encapsulation, Fat substitutes based on carbohydrates and proteins. Formulation and characterization of low-fat spreads, whipped creams, margarines, mayonnaise, salad dressings etc. Bakery shortenings chemistry, formulation and technology. Trans-fatty acids- formation during processing and nutritional aspects, Enzymatic approach to tailor made fats.
Practical: Assay of lipid degradation and polymerization products in fried foods and fried oils; analysis of phytosterols, trans-fatty acids and omega fatty acids; preparation of fat and cream powders; formulation and stabilization of low fat spreads, margarines and mayonnaise based on locally available fats; applications of emulsifiers in industrially produced foods.

FT 606  Protein Technology  2+1  Sem. I
Protein structure and chemistry; protein -protein interactions, methods of evaluation of protein quality and amount, Conventional and novel sources of protein. Production of proteins, protein concentrates/isolates from legumes, oilseeds, fish, seafood, leaf, microbes. Functional properties of proteins and their applications; Structure-function relationships of different food proteins, textured vegetable proteins and different methods of texturization. High protein food formulations, Modification of proteins by enzymic (manufacture of protein hydrolysates, their characterization and applications), chemical and physical methods. Interactions of proteins with flavours, polysaccharides, lipids and their technological effects, Protein-based fat substitutes, Protein engineering.
Practical: Isolation of proteins from different raw materials such as soybeans, oilseed meals, fish, leaves, milk; preparation of protein isolates, concentrates and hydrolysates and evaluation of their nutritional and functional properties; development of high-protein food formulations; visits to industrial units manufacturing protein-based products.

FT 491  B.Tech. Seminar
FT 591  Seminar
FT 600  Master's Research
FT 700  Ph.D. Research
FORESTRY AND NATURAL RESOURCES

PROGRAMMES
M. Sc.

COURSE REQUIREMENTS
Field of Specialization  Silviculture and Forest Management, Tree Improvement, Agroforestry, Forest Ecology and Wildlife.

Required Courses  Forst. 501, Forst. 502, Forst. 503, Forst. 504, Forst.505, Forst. 506

Supporting Courses  Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem.

Minor Fields  Agronomy, Biotechnology, Botany, Economics, Plant Breeding and Genetics, Vegetable Science, Fruit Science, Floriculture and Landscaping, Soil Science or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students with elective other than Agronomy, Soil Science and Forestry  9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses
Forst. 301 Introduction to Forestry  1+1  Sem. I

Undergraduate Elective /M. Sc. Supporting/Minor Courses
Forst. 433 Production Technology of Economic Forest Trees  2+1  Sem. I
Plantation silviculture: native versus exotics; even-aged versus uneven-aged; monoculture versus mixed culture. Plantation technology and tending operations of economically important tree species. Agroforestry concept and suitable agroforestry systems/models for different regions. Economic and ecological aspects of agroforestry systems. Importance of superior phenotypes, their evaluation and use in plantations. Climate change and forests. Forest regeneration, productivity and rotation. Desertification and rehabilitation of waste lands. Short rotation intensive management of forest plantations. Trees
outside forests, energy/industrial plantation and dendo-remediation. Production and marketing of forestry produce. Forest fire and its management. Wood based industries and importance of non-timber forest produce. Framework for forestry extension: participatory rural appraisal and joint forest management.


**Postgraduate Courses**

**Forst. 501 Silviculture**  

**Forst. 502 Forest Biometry and Management**  
Definition, importance and scope. Measurement of tree parameters. Estimation of volume, growth and yield of individual tree and forest stands. Preparation of volume, yield and stand tables and their application. Forest inventory, sampling methods adopted in forestry, use of GPS in forest inventory and computer analysis of inventory data. Measurement of stand density. Simulation techniques. Growth and yield prediction models - their preparation and applications. Principles of forest management; scope and objective of forest management, development of forest management in India. Need for man-made forests. Site quality evaluation and importance. Stand growth, classical approaches to yield regulation in forest management, salient features and strategies. Forest valuation and appraisal in regulated forests. Forests and its importance, forest societies, interactions between forests and people, social and cultural factors of forest management. Gender dimension of forest management, tribal economy and forests. Forests and food security, eco-tourism and local development, land use change and forestry.


**Forst. 503 Forest Ecology and Biodiversity Conservation**  

**Forst. 504 Forest Protection and Conservation**  
(In collaboration with Deptts. of Entomology, Plant Pathology and Zoology) Important pests of forest nurseries and plantations. Management strategies for control of pests. Breeding trees for resistance against key insects-pests and diseases. Mycoflora of tree seeds and management; role of mycorrhiza in tree

Practical: Collection, identification and preservation of important insect-pests and disease specimens of forest trees, extraction of spores of VAM from soil and assessment of mycorrhizal root infestation, detection of insect infestation and seed borne mycoflora; estimation of losses caused by insects and diseases, laboratory tests for estimating decay resistance in wood, demonstration of power operated sprayer, spray technology for trees, fire control methods and devices.

**Forst. 505 Tree Improvement** 1+1 Sem. I


**Forst. 506 Agroforestry** 1+1 Sem. II


**Forst. 507/ Econ 520 Forest Resource Management and Economics** 1+1 Sem. I

Importance of Forests, use of economic principles in forest resources problems. Forest products, demand and supply analysis, forest products marketing, forest capital theory. Inter-regional and international trade in forest products. Impact of economics and physical variables upon forest appraisal and management decisions. Externalities and property rights. Natural and environmental resource accounting -methods and implications. Application of operations research tools in evaluating forest management alternatives in public and private forest planning.

Practical: Exercises on estimation of demand and supply functions; biodiversity valuation, valuation of non-marketed forest products. Exercises on financial and economic appraisal of forestry projects. Exercises on marketing of forest products and international trade competitiveness. Computer applications for using programming techniques in evaluating forest management alternatives.

**Forst. 508 Forest Policy, Laws and International Conventions** 2+0 Sem. I

Forest policy - Relevance and scope; National Forest Policy - 1894, 1952 and 1988. General principles of criminal law; Indian Penal Code, criminal procedure code; Indian evidence act applied to forestry matters. Forest laws; Indian Forest Act -1927, the state amendments - Punjab and Haryana general provision and

**Forst. 509 Forests and People**

Forest societies, people and forests interactions between forests and people. Importance of forests in traditional farming systems, livestock economy and forests, social and cultural factors of forest management. Afforestation programmes and forest conflicts, wildlife and human conflicts, important forest movements like Chipko movement. Gender dimension of forest management. Pastoralists and their dependence on forests. Forests and economic security of tribals. Forests and food security, ecotourism and local development, land use change and forestry. Forest rights, customary rights of people, community participation, ethanobotany, Joint Forest Management, global environmental change and land use, dams, forests and resettlement of tribals and non-tribals - case study. Poverty alleviation and forests, role of NGOs and other community based organizations in forest management.

**Forst. 510 Forest Products - Chemistry and Industries**


Practical: Estimation of cell wall contents - Hemicellulose and lignin, extraction of essential oils, resins, tannins, acetylation of wood. Moisture content, specific gravity and calorific value determination of wood samples. Determination of strength properties of wood. Visit to nearby forest based industries. Visit to State Forest Corporation's saw mill and wood fabrication unit.

**Forst. 591 Seminar**

**Forst. 600 Master's Research**
FRUIT SCIENCE

PROGRAMMES
1. M. Sc.
2. Ph. D.

COURSE REQUIREMENTS

M. Sc.
Field of Specialization: Nursery Production, Fruit Production, Orchard Management, Horti.-Agro Techniques, Post- harvest Handling
Required Courses: Hort. 501, Hort. 502, Hort. 503, Hort. 504, Hort. 505
Supporting Courses: Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem.
Minor Fields: Botany, Biochemistry, Biotechnology, Plant Breeding and Genetics, Soil Science, Vegetable Science or any other as approved by Dean, postgraduate Studies.
Deficiency Courses for Student's with elective other than Horticulture: 9-12 credit hours of atleast 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph. D.
Field of Specialization: Nursery Production, Fruit production, Orchard Management, Horti.-Agro Techniques, Post- harvest Handling
Required Courses: Hort. 601, Hort. 602, Hort. 603
Supporting Courses: Courses from subject matter fields (other than minor) relating to area of special interest and research problem.
Minor Fields: Botany, Biochemistry, Biotechnology, Plant Breeding and Genetics, Soil Science, Vegetable Science or any other as approved by Dean, postgraduate Studies.
Deficiency courses for students with M. Sc. (Agri.) in a discipline other than Pomology: Hort. 501, Hort. 502, Hort. 503, Hort. 504, Hort. 505 and other courses as recommended by Student's Advisory Committee.

DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Hort. 91 Horticulture-I
Elements of Horticulture; types of fruits and vegetables; their economic importance and role in human nutrition; agro-climatic requirements; methods of propagation and cultural practices of important fruits and vegetables in the State; kitchen gardening; introduction to floriculture, landscape and gardening; annual and woody ornamentals.
Practical: Identification of important fruits and vegetable crops/ species/ varieties; seed and soil sterilization; nursery raising of flowering annuals; vegetable and fruit crops; lay out system for kitchen gardening; planting of fruit trees; practices and propagation of fruit plants; training and pruning of fruit trees; visit to floriculture and landscaping area.
Hort. 203 Production Technology of Fruit Crops  
2+1  
Sem. I

Hort. 301 Post-harvest Management of Fruits and Vegetables  
1+1  
Sem. I
(Collaboration: Department of Vegetable Science)
Importance. Maturity indices, harvesting and post harvest handling of fruits and vegetables. Maturity and ripening process. Factors affecting ripening and deterioration of fruits and vegetables. Chemicals used for delaying and hastening ripening. Methods of storage and low cost storage structures. Methods of packing, packaging materials and transport. Types of containers, cushioning material, vacuum packing, shrink packing, specific packing for export of mango, banana, grapes, Kinnow, sweet orange, and mandarin etc. Unit layout - selection of site and precautions for hygienic conditions.

Undergraduate Elective/M.Sc. Supporting/Minor Courses

Hort. 433 Nursery Management of Horticultural Crops  
2+1  
Sem. I

Hort. 434 Commercial Fruit Production  
2+1  
Sem. I
Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties, horti-agri techniques, production, plant protection measures and special problems in fruits such as citrus, mango, guava, apple, pear, peach, plum, ber, litchi, grapes, pomegranate, papaya, pineapple, phalsa, banana and sapota.
Practical: Identification of species and fruit varieties, training and pruning, maturity standards, harvesting, handling, grading and packing of fruits. Project formulation and valuation of orchard management.

Hort. 435 Processing and Value Addition of Horticultural Crops  
2+1  
Sem. I
(In collaboration with Department of Food Science and Technology)
Scope of fruit preservation industry in India, present status, constraints and prospects. Importance, principles and practices of fruit processing. Maturity indices, harvesting, transportation and quality
parameters of fruits. Pre and post harvest factors affecting processing quality of fruits. Commercial processing technologies for fruits like mango, citrus, guava, grapes, ber, apple, pear, peach, plum, phalsa, litchi, pomegranate and papaya etc. Packing technology for export and value addition.

Practical: Judging of maturity of different fruits. Methods of preparation of jam, jelly, ready to serve, squash, nectar, canning, chutney, pickle and marmalade etc. Packing technologies. Drying and dehydration of fruits. Visit to local processing unit.

Postgraduate Courses

Hort. 501 Tropical and Dry Land Fruit Production 2+1 Sem. I


Hort. 502 Sub-tropical and Temperate Fruit Production 2+1 Sem. II


Hort. 503 Nutrient and Canopy Management in Fruit Crops 2+1 Sem. II

Practical: Leaf sampling techniques, Determination of nutrient status through soil and plant analysis. Study of different types of canopies. Training of plants for different canopy types. Canopy development through pruning, use of plant growth inhibitors and, geometry of planting. Effect of canopy types on production and quality of fruits.

Hort. 504 Principles and Practices of Plant Propagation 2+1 Sem. II


Hort. 505 Breeding of Fruit Crops 2+1 Sem. I
Origin and distribution, taxonomical status of species and cultivars. Cytogenetics and genetic resources. Blossom biology, breeding objectives, systems and ideotypes. Crop improvement through introduction, selection, hybridization, mutation breeding, polyploid breeding and rootstock breeding. Improvement of quality traits. Resistance breeding for biotic and abiotic stresses. Biotechnological interventions, achievements and future thrust. The important temperate, sub- tropical and tropical fruit crops will be covered.


Hort. 506 Post-harvest Technology for Fruit Crops 2+1 Sem. II


Hort. 507 Growth and Development of Horticultural Crops 2+1 Sem. I


Hort. 508 Orchard Management and Organic Horticulture 2+1 Sem. I

Hort. 601 Advances in Breeding of Fruit Crops (pre-requisite Hort. 505) 3+0 Sem. I
Evolutionary mechanisms, adaptation and domestication. Genetic resources, cytogenetics, cytomorphology, chemotaxonomy, genetics of important traits and their inheritance pattern. Variations and natural selection, spontaneous mutations, incompatibility systems in fruits. Recent advances in crop improvement through introduction and selection, chimeras, apomixis, clonal selections, intergeneric, interspecific and intervarietal hybridization, mutation and polyploid breeding, resistance breeding to biotic and abiotic stresses. Breeding for improving quality. Molecular and transgenic approaches in improvement of selected fruit crops: Mango, banana, papaya, grapes, citrus fruits, guava, sapota, pineapple, avocado, apple, pear, plums, peach, apricot, cherries and strawberry.

Hort. 602 Advances in Production of Fruit Crops 3+0 Sem. II

Hort. 603 Advances in Growth Regulation of Fruit Crops 3+0 Sem. II

Hort. 604 Advances in Nutrition of Fruit Crops 3+0 Sem. I

Hort. 605 Biotic and Abiotic Stress Management in Fruit Crops. 3+0 Sem. I
PLANT BREEDING AND GENETICS

PROGRAMMES:
1. M. Sc.
2. Ph. D.

COURSE REQUIREMENT

M. Sc.
Field of Specialization: Plant Breeding, Genetics, Cytogenetics
Required Courses: PBG 501, PBG 502, PBG 503, PBG 504, and PBG 505
Supporting Courses: Stat. 421, PGS 501, and other courses from subject matter fields (other than minor) related to area of special interest and research problem.
Minor Fields: Biotechnology, Statistics, Plant Pathology, Entomology, Botany, Biochemistry, Microbiology, Agronomy, or any other as approved by the Dean, Postgraduate Studies.
Deficiency courses for students with elective other than Plant Breeding, Genetics and Biotechnology: 9-12 credit hours of at least 400 series courses as recommended by the Dean, Postgraduate Studies.

Ph.D.
Field of Specialization: Plant Breeding, Genetics, Cytogenetics
Required Courses: PBG 601, PBG 602, PBG 603
Supporting Courses: Courses from subject matter fields (other than minor) related to area of special interest and research problem.
Minor Fields: Biotechnology, Statistics, Plant Pathology, Entomology, Botany, Biochemistry, Microbiology, Agronomy, or any other as approved by the Dean, Postgraduate Studies.
Deficiency courses for students with M. Sc. in discipline other than Plant Breeding and Genetics: PBG 501, PBG 502, PBG 503, PBG 504, PBG 505, and other courses as recommended by Student's Advisory Committee.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

PBG 102 Introductory Genetics  
(For College of Home Science)  

PBG 103 Introduction to Genetics  
Mendel's laws of inheritance and exceptions to the laws, Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Qualitative traits. Quantitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, its characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and its characteristic features; Methods of inducing mutations and detection of sex linked and autosomal mutations, CIB technique. Gene expression and differential gene activation; Lac operon and fine structure of gene; Ultra structure of cell, cell organelles and their functions; Study of chromosome structure, morphology, number and types. Karyotype and idiogram; Mitosis and meiosis, their significance and differences between them; DNA and its structure, function, types, modes of replication and repair. RNA and its structure, function and types; Transcription, Translation. Genetic code and outline of protein synthesis; Crossing over and factors affecting it; Mechanism of crossing over and Cytological proof of crossing over; Linkage, types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyplody) and evolution of different crop species like cotton, wheat, tobacco, triticale and Brassicas; Structural chromosomal aberrations.

Practical: Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various mitosis and meiosis; Monohybrid, Dihybrid and Trihybrid ratios and their modifications; Chi-square analysis and Interaction of factors; Epistatic factors, Supplementary factors and Duplicate factors; Complementary factors, Additive factors and Inhibitory factors; Linkage - Two point test cross; Linkage - Three point test cross; Induction of polyploidy using colchicine; Induction of chromosomal aberrations using chemicals.

PBG 202 Principles of Seed Technology  
Introduction of Seed Production. Importance of Seed Production. Seed policy. Seed demand forecasting and planning for certified, foundation and breeder seed production. Deterioration of crop varieties. Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed. Different classes of seed. Production of nucleus and breeder seed. Maintenance and multiplication of pre-release and newly released varieties in self and cross-pollinated crops; Seed Production. Foundation and certified seed production in maize (varieties, hybrids, synthetics and composites). Foundation and certified seed production of rice (varieties and hybrids). Foundation and certified seed production of sorghum and bajra (varieties, hybrids, synthetic and composites); Foundation and certified seed (varieties and hybrids) production of castor, tomato, brinjal, chillies, bhindi, onion, bottle gourd and ridge gourd. Seed certification. Phases of certification, procedure for seed certification, field inspection and field counts etc. Seed Act and its enforcement. Central Seed Committee. Central Seed Certification Board. State Seed Certification Agency. Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order, Seed control order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights. Patenting, WTO, Plant Breeders Rights. Varietal Identification through grow-out test and Electrophoresis; Seed Drying; Forced air seed drying principle, properties of
air and their effect on seed drying, moisture equilibrium between seed and air. Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature, management of seed drying. Planning and layout of seed processing plant. Establishment of seed processing plant. Seed processing, air-screen machine and its working principle, different upgrading equipments and their use. Establishing a seed testing laboratory. Seed testing procedures for quality assessment. Seed treatment. Importance of seed treatment, types of seed treatment, equipment used for seed treatment (slurry and Mist-O-matic treater). Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during store and conditions required for good storage. General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control. Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy and factors affecting seed marketing. Practical: Seed sampling principles and procedures; Physical purity analysis of field and horticultural crops; Germination analysis of field and Horticultural Crops; Moisture tests of Field and Horticultural crops; Viability test of field and horticultural crops; Seed health test of field and horticultural crops; Vigour tests of field and horticultural crops; Seed dormancy and breaking methods; Grow-out tests and electrophoresis for varietal identification; Visit to seed production plots of maize; sunflower, bajra, rice, wheat, sorghum, cotton, chillies and vegetables. Visit to seed processing plants, seed testing laboratories, grow-out testing farms and hybrid seed production farms. Varietal identification in seed production plots, planting ratios, isolation distance and flowering etc.

PBG 303 Introduction to Plant Breeding 2+1 Sem. I

Classification of plants, botanical description, floral biology, emasculation and pollination techniques in cereals, millets, pulses, oilseeds, fibers, plantation crops etc. Aims and objectives of Plant Breeding; Modes of reproduction- sexual, asexual, apomixis; Significance in plant breeding; Modes of pollination, genetic consequences, differences between self- and cross-pollinated crops; Methods of breeding - Introduction and Acclimatization; Selection, mass Selection, Johannsen's pure-line theory, genetic basis, pure-line selection; Hybridization, aims and objectives, types of hybridization; Methods of handling segregating generations, pedigree method, bulk method, back cross method; Incompatibility and male sterility and their utilization in crop improvement; Heterosis, inbreeding depression, various theories of heterosis, exploitation of hybrid vigor, development of inbred lines, single-cross and double-cross hybrids; population improvement programmes, recurrent selection, synthetics and composites; Methods of breeding vegetatively propagated crops, clonal selection; Mutation breeding; Ploidy breeding; Wide hybridization and its significance in crop improvement.

Practical: Botanical description and floral biology; Study of megasporogenesis and microsporogenesis. Fertilization and life cycle of an angiospermic plant; Plant Breeder's kit: Hybridization techniques and precautions to be taken; Floral morphology, selfing, emasculation and crossing techniques; Study of male sterility and incompatibility; Field crops: rice, sorghum, maize, wheat, bajra, sugarcane, brassicas, groundnut, sunflower, sesame, red gram, bengal gram, green gram, soybean, black gram, cotton, chillies, brinjal, tomato, bhindi, onion and bottle gourd.

PBG 304 Breeding of Field and Horticultural Crops 2+1 Sem. II

(Collaboration: Department of Floriculture and Landscaping, Fruit Science and Vegetable Science)

Breeding objectives and important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops; Hardy-Weinberg Law; Study in respect of origin, distribution of species, wild relatives and forms, Cereals, (rice, wheat, maize, millets, sorghum, bajra); Pulses (red gram, green gram, black gram, soybean); Oilseeds (Groundnut, sesame, sunflower, brassicas) etc. Fibres (Cotton) etc. Vegetables (Tomato, bhindi, chilli, cucumbers); Flowers crops (Chrysanthemum, rose, gaillardia and marigold); Fruit crops (amla, guava, mango, banana, papaya); Major breeding procedures for development of hybrids/varieties of various crops; Plant genetic resources, their conservation and utilization in crop improvement; Ideotype concept in crop improvement; Breeding for resistance to biotic and abiotic stresses. Variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pests; Genetic basis of adaptability to unfavourable environments; Definition of biometrics, assessment of variability i. e.,
additive, dominance and epistasis and their differentiation; genotype x environment interaction and influence on yield/performance. IPR and its related issues.

Practical: Emasculation and Hybridization techniques; Handling of segregating generations-pedigree method, bulk method, back cross methods; Field layout of experiments; Field trials, maintenance of records and registers; Estimation of heterosis and inbreeding depression; Estimation of heritability; GCA and SCA; Estimation of variability parameters; Parentage of released varieties/hybrids; Problems on Hardy-Weinberg Law; Study of quality characters; Sources of donors for different characters; Visit to seed production and certification plots; Visit to AICRP trials and programmes; Visit to grow-out test plots; Visit to various research stations; Visit to other institutions.

Undergraduate Elective/M.Sc. Supporting/Minor Courses

PBG 433 Genetics of Crop Plants 2+1 Sem. I


PBG 434 Cytogenetics of Crop Plants 2+1 Sem. I

PBG 435 Theory and Practice of Plant Breeding 3+1 Sem. I

PBG 436 Introduction to Breeding of Field Crops 3+0 Sem. I
Application of genetic, cytogenetic and biotechnological techniques in breeding of wheat, triticale, rice, maize, bajra, barley, sorghum, cotton, sugarcane, important pulses, oilseeds and forage crops including their origin and germplasm sources. Problems and present status of crop improvement in India with emphasis on the work done in Punjab. National and International centres of crop improvement.

PBG 437 Crop Experimentation 1+1 Sem. I
Experiments in Plant Breeding - objectives, analysis and interpretation of results. Statistics in relation to crop experimentation. Principles of experimental designs. Uniformity trials, progeny rows trials, compact family block design, completely randomized block design, randomized block design, incomplete block
Postgraduate Courses

PBG 501 Principles of Genetics
2+1 Sem. I


PBG 502 Principles of Cytogenetics
2+1 Sem. II


PBG 503 Principles of Plant Breeding
2+1 Sem. I

records. Estimation of heterosis and inbreeding depression. Techniques in hybrid seed production using male-sterility in field crops.

**PBG 504 Principles of Quantitative Genetics 2+1 Sem. II**


**PBG 505 Heterosis Breeding 2+1 Sem. II**


**PBG 506 Mutagenesis and Mutation Breeding 1+1 Sem. I**


Practical: Mutagenic agents. Visit to radio isotope laboratory. Treating the plant propagules at different doses of physical and chemical mutagens. Raising the crop for observation- Study of M1, M2 generation - Parameters to be observed. Mutation breeding in cereals, pulses, oilseeds, cotton, forage crops and vegetatively propagated crops. Procedure for detection of mutations for polygenic traits in M2 and M3 generations.

**PBG 507 Population Genetics 2+1 Sem. II**


PBG 508 Cell Biology and Molecular Genetics  


PBG 509 Breeding for Biotic and Abiotic Stress Resistance  

PBG 510 Breeding Field Crops  
Evolution and distribution of species and forms, wild relatives and germplasm, genetics, cytogenetics, genome relationship, breeding objectives, achievements and hybrid breeding in wheat, rice, maize, sugarcane, forage legumes, chickpea, other pulses, groundnut, rapeseed and mustard, sunflower, soybean and cotton. Distinguishing features of popular released varieties in rice, wheat, maize, sugarcane, pulses, oilseeds and cotton and their application to DUS testing. Maintenance of seed purity and seed production.


PBG 511 Breeding for Quality Traits  


**PBG 512 Gene Regulation and Expression**  
2+0  
Sem. I


**PBG 513 Maintenance Breeding and Concepts of Variety Release and Seed Production**  
1+1  
Sem. I


Practical: Identification of suitable areas for seed production. Ear-to-row method and nucleus seed production. Main characteristics of released and notified varieties, hybrids and parental lines. Identification of important weeds/objectionable weeds. Determination of isolation distance and planting ratios in different crops. Seed production techniques of varieties in different crops. Hybrid seed production technology of important crops.

**PBG 514 Collection, Management and Utilization of Plant Genetic Resources**  
3+1  
Sem. II


Practical: Plant exploration and collection. Introductions. Techniques of coarse and fine grid surveys. Identification of wild relatives of crop plants. Estimation of sample size during plant explorations, impact of sampling, sequential sampling. Sample size for storage and viability testing. Test cases to understand quarantine regulations. Techniques for the detection of insects, mites, nematodes, bacteria, weeds, pathogens and viruses on seed and planting materials and salvaging. Use of visual, qualitative, quantitative, microscopic, molecular and plant growth related techniques (controlled green houses/growth chambers, etc). Detection of GMOs and GEPs. Study of post-entry quarantine operation, seed treatment and other prophylactic treatments and preparation of herbarium specimens. Analysis of genetic diversity. Information management


agronomically ideal genotypes into male steriles, new cytonuclear interaction system for diversification of male steriles, photo and thermo sensitive genetic male sterility. Apomixis and its use in heterosis breeding. Incongruity.

PBG 604 Breeding Designer Crops 2+1 Sem. II
Breeding of crop ideotypes. Genetic manipulations through recombination breeding, genomics and transgenics for physiological efficiency, nutritional enhancement: proteins, vaccines, gums, starch and fats. Physiological efficiency, parametric and whole plant physiology for improvement in nutrient use efficiency, water use efficiency, osmotic adjustment, photosynthetic efficiency, stay green trait and its significance in crop improvement. Improvement in yield potential under sub-optimal conditions by manipulating source and sink, canopy architecture, plant-water relationships. Enhancing input use efficiency through genetic manipulations. Breeding for special traits viz., oil, protein, vitamins, amino acids etc. Biopharming and development of varieties producing vaccines, modified sugars, gums and starch. Biosafety management, segregation and isolation requirements in designer crop production and post-harvest management.

Practical: Demonstration of plant responses to stresses through recent techniques. Water use efficiency, transpiration efficiency, screening techniques under stress conditions such as electrolyte leakage, TTC, chlorophyll fluorescence, canopy temperature depression, stomatal conductance, chlorophyll estimation, heat/drought/salt shock proteins.

PBG 605 Plant Genetic Resources and Crop Evolution 2+0 Sem. I

PBG 606 Advanced Biometrical and Quantitative Genetics 2+1 Sem. I

PBG 607 Advances in Breeding of Major Field Crops 3+0 Sem. I
History, description, classification, origin and phylogenetic relationship, genome status in cultivated and alien species of major cereals and millets like rice, wheat, maize, pearl millet, sorghum, pulses, oilseeds, cotton, sugarcane, arid legumes and other forage crops etc. Breeding objectives of major crops. Genetic resources and their utilization. Genetics of quantitative and qualitative traits. Breeding for value addition and resistance to abiotic and biotic stresses. Conventional (line breeding, population improvement, hybrids) and other approaches (DH Populations, Marker Assisted Breeding, Development of
new male sterility systems and transgenics). National and International accomplishments in genetic improvement of major field crops and their seed production.

**PBG 608 Microbial Genetics**

2+1 Sem. I


**PBG 609 In Situ and Ex Situ Conservation of Germplasm**

2+1 Sem. II


Practical: In situ conservation of wild species - case studies at National and International levels - ex situ techniques for active and long-term conservation of collections - Preparation and handling of materials, packaging, documentation. Design of cold storage modules - Conservation protocols for recalcitrant and orthodox seeds. Cytological studies for assessing genetic stability, in vitro cultures-embryo, cell/suspension cultures, pollen cultures, study of cryotank facility and vitrification techniques. Visit to NBPGR/NBAGR.

**PBG 591 Seminar**

**PBG 600 Master's Research**

**PBG 700 Ph. D. Research**
PLANT PATHOLOGY

A. PLANT PATHOLOGY PROGRAMME

1. M.Sc.
2. Ph.D

COURSE REQUIREMENTS

M. Sc.
Field of Specialization
Fungal Pathology, Plant Bacteriology, Plant Virology
Required Courses
Pl.Path.501, Pl. Path. 502, Pl.Path.503, Pl.Path.504, Pl.Path.505
Supporting Courses
Stat.421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem.
Minor Fields
Agrometeorology, Biochemistry, Entomology, Fruit Science, Nematology, Plant Breeding and Genetics, Biotechnology, Vegetable Science, or any other as approved by the Dean, Postgraduate Studies.
Deficiency courses for students with elective other than Crop Protection
9-12 credit hours of atleast 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D
Field of Specialization
Fungal Pathology, Plant Bacteriology, Plant Virology
Required Courses
Pl. Path. 601, Pl. Path. 602, Pl.Path.603, Pl.Path. 604, Pl. Path. 605
Supporting Courses
Courses from subject matter fields (other than minor) relating to area of special interest and research problem.
Minor Fields
Agrometeorology, Biochemistry, Entomology, Fruit Science, Nematology, Plant Breeding and Genetics, Biotechnology, Vegetable Science, or any other as approved by the Dean, Postgraduate Studies.
Deficiency courses for students with M. Sc. (Agri.) in a discipline other than Plant Pathology
Pl.Path.501, Pl.Path.502, Pl.Path.503, Pl.Path.504, Pl. Path. 505, and other courses as recommended by Student's Advisory Committee.

DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Pl. Path. 101 Plant Pathogens and Principles of Plant Pathology


Pl. Path. 201 Diseases of Field Crops and their Management 2+1 Sem. I
Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, barley, sugarcane, turmeric, tobacco, groundnut, sesame, castor, sunflower, rapeseed & mustard, cotton, pulses, mentha and berseem.
Practical: Study of symptoms and host-parasite relationships of important diseases of field crops. Field visits at appropriate time during the semester.

Pl. Path. 303 Diseases of Horticultural Crops and their Management 2+1 Sem. II
Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of diseases of citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, ber, apple, pear, peach, plum, chilli, brinjal, okra, potato, crucifers, cucurbits, tomato, pea, beans, onion, garlic, coriander, coconut, betelvine, mulberry, coffee, tea, rose, chrysanthemum, gladiolus, marigold and jasmine.
Practical: Study of symptoms and host-parasite relationships of important diseases of horticultural crops. Field visits at appropriate time during the semester.

Undergraduate Elective/M. Sc. Supporting/ Minor Courses

Pl. Path. 433 Plant Disease Diagnosis 0+2 Sem. I

Pl. Path. 434 Biocontrol and Integrated Disease Management 2+2 Sem. I

Pl. Path. 435 Post Harvest Diseases and their Management 2+1 Sem. I
Importance of post-harvest diseases. Important post-harvest diseases of fruits and vegetables. Factors affecting ripening of fruits and vegetables. Factors favoring development of post-harvest diseases. Effect of

Postgraduate Courses

Pl. Path. 501 Mycology 2+1 Sem. I

Pl. Path. 502 Plant Virology 2+1 Sem. II

Practical: Study of symptoms caused by viruses, transmission, assay of viruses, physical properties, isolation and purification, method of raising antisera, serological tests, electron microscopy and ultratomy, molecular diagnostics. Diagnosis of representative viral diseases.

Pl. Path. 503 Plant Bacteriology 2+1 Sem. II


Pl. Path. 504 Principles of Plant Pathology 3+0 Sem. I
Pl. Path. 505 Principles of Plant Disease Management 2+1 Sem.I
Practical: In vitro and in vivo evaluation of chemicals against plant pathogens. Foliage, seed and soil application of chemicals. Role of stickers, spreaders and other adjuvants. ED and MIC values. Study of structural details of sprayers and dusters. Environmental hazards, residual effects and safety measures.

Pl. Path. 506 Detection and Diagnosis of Plant Diseases 0+2 Sem. II

Pl. Path. 507 Integrated Disease Management 2+1 Sem. I
Introduction, definition, concept and tools of disease management. Components of integrated disease management, their limitations and implications. Development of IDM and its adaptation in important crops, rice, wheat, cotton, sugarcane, chickpea, rapeseed mustard, pearlmillet, Kharif pulses, vegetable and fruit crops.
Practical: Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM. Demonstration of IDM in certain crops as project work.

Pl. Path. 508 Epidemiology and Forecasting of Plant Diseases 2+0 Sem. II
Epidemic concept and historical development, pathometry and crop growth stages, epidemic growth and analysis. Common and natural logarithms, function fitting area under disease progress curve and correction factors, inoculum dynamics, population biology of pathogens, temporal spatial variability in plant pathogens. Survey, surveillance and vigilance, crop loss assessment and models. Principles and pre-requisites of forecasting, systems and factors affecting various components of forecasting, some early forecasting, procedures based on weather and inoculum potential, modelling disease growth and disease prediction.

Pl. Path. 509/Ent.509/Nem. 509 Molecular Approaches in Plant Protection 2+1 Sem.II

Pl. Path.510/ Ent.510/ Nem. 510 Quarantine in Plant Protection 2+0 Sem.II
Definition of pest and pesticides and transgenics as per Govt. notification. Relative importance and quarantine for domestic and international. Quarantine restrictions in the movement of agricultural produce including seeds and planting material. Case histories of exotic pests and diseases and their status. Plant protection organization in India. Acts related to registration of pesticides and transgenics. History of quarantine

Pl. Path. 511 Post Harvest Diseases 2+1 Sem. II
Practical: Isolation, characterization and maintenance of important post-harvest pathogens. Role of different storage conditions for disease development. Application of antagonists against pathogens under in vitro and in vivo conditions. Comparative efficacy of different chemicals, fungicides, phyto-extracts and bioagents.

Pl. Path. 512 Fungal Diseases of Plants 2+1 Sem. I
Nomenclature, classification and general characterization of fungi. Description of important phytopathogenic genera. Study of representative fungal diseases with emphasis on their distribution, symptomatology, etiology, epidemiology and control. Post harvest diseases in transit and storage and their management.
Practical: Characteristics of important phytopathogenic genera and of fungi and their identification. Macro and microscopic diagnosis of representative diseases of various crops.

Pl. Path. 601 Ecology of Plant Pathogens 2+0 Sem.II
Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi. Dispersal, survival and dormancy of plant pathogens. Types of biocontrol agents. Inoculum potential and density in relation to host and soil variables, competition, predation, antibiotic and fungistasis. Role of rhizosphere, phyllosphere and spermosphere in disease development in relation to crop sequences. Suppressive soils, biological control, concepts and potentialities for managing soil borne pathogens.

Pl. Path. 602 Molecular Basis of Host-Pathogen Interaction 2+0 Sem.II

Pl. Path. 603 Principles and Procedures of Certification 2+0 Sem.II
Introduction to certification. International scenario of certification and role of ISTA, EPPO, OECD etc. in certification and quality control. Case studies of certification systems of USA and Europe. National Regulatory mechanism and certification system including seed certification, minimum seed certification standards. National status of seed health in seed certification. Methods for testing vegetative propagules and in vitro...
cultures and genetic identity, physical purity, germination percentage, seed health etc. Fixing tolerance limits for diseases and insect pests in certification and quality control programmes. Accreditation of seed testing laboratories. Role of seed/planting material health certification in national and international trade.

Pl. Path. 604 Advanced Systematic Mycology  
3+0  Sem.I

Pl. Path. 605 Advanced Plant Virolology  
2+0  Sem. II

Pl. Path. 606 Advanced Plant Bacteriology  
2+0  Sem.I

Pl. Path. 591 Seminar
Pl. Path. 600 Master's Research
Pl. Path. 700 Ph. D. Research
B. NEMATOLOGY PROGRAMME

M.Sc.

COURSE REQUIREMENTS

Field of Specialization

Nematode Taxonomy, Host-parasite Relationships, Nematode Management, Nematode Ecology, Nematode Biology

Required Courses


Supporting Courses

Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields

Entomology, Fruit Science, Microbiology, Plant Pathology and Vegetable Science or any other as approved by the Dean, Postgraduate Studies

Deficiency courses for students with elective

9-12 credit hours of at least 400 series courses as recommended by the Student’s Advisory Committee and approved by the Dean, Postgraduate Studies

Other than Crop Protection Studies

Undergraduate Elective/M.Sc. Supporting/Minor Courses

Nem. 433 Plant Nematology 1+1 Sem. I

History and economic importance of plant parasitic nematodes. General characteristics, identification, their classification and relationship with other organisms. Morphology and biology of important genera, namely Meloidogyne, Heterodera, Globodera, Anguina, Rotylenchulus, Ditylenchus, Tylenchulus, Pratylenchus, Radopholus and virus vectors. Principles and methods of control.


Postgraduate Courses

Nem. 501 Structural and Functional Organization of Nematodes 2+1 Sem. I


Practical: Studies on variation in nematode shapes and sizes, morphological details of cuticle, cuticular markings and ornamentation, variations in stoma, esophagus, rectum; types and parts of female and male reproductive systems, sense organs, and excretory system.

Nem. 502 Classification of Nematodes 2+1 Sem. I

Nematode systematics and comparison with its allies. Comparative study of morphological and allometric variations and evaluation of characters of classification. Classification of Phylum Nematoda. Orders of class Adenophorea and Secernentea. Diagnosis of order Tylenchida-Suborder Tylenchina, Hoplolaimina and Criconematina, their families and genera. Diagnosis of genera and families of orders Aphelenchida, Dorylaimida, Enoplida, Rhabditida with emphasis on economically important taxa.

Practical: Identification of common plant parasitic nematodes belonging to orders Tylenchida, Dorylaimida, Aphelenchida and Enoplida up to generic level and up to species level for major nematode pests of crops with the help of keys and illustrations. Identification of Entomopathogenic nematodes belonging to Order Rhabditida.
Nem. 503  Nematological Techniques  1+2  Sem.I

Nem. 504 Nematode Diseases of Crops  2+1  Sem.II
Practical: Diagnosis of causal organisms. Identification of different life cycle stages. Study of symptoms and histopathology of nematode damage in different crops and field diagnosis of nematode problems.

Nem. 505 Nematode Management  2+1  Sem.II
Practical: In vitro screening of synthetic chemicals and plant products for nematicidal activity, and their application methods. Methods for screening of crop germplasm for resistance against nematodes. Laboratory exercises on biocontrol potential of fungal, bacterial parasites, predaceous fungi and nematodes.

Nem. 506 Principles of Taxonomy  2+0  Sem.I

Nem. 507 Nematode Biology and Physiology 1+1 Sem.I
Host finding, invasion, feeding, hatching, moultng and life cycle patterns in different types of nematodes. Types of reproduction, gametogenesis, embryogenesis and post embryogenesis in nematodes. Physiology of body wall and chemical composition of nematodes. Hydrolytic enzymes, pseudocoelom and function of transport in nematodes. Physiology of digestive system. Respiration and intermediary metabolism. Osmoregulation. Physiology of nutrition, excretory-secretory and neuromuscular systems in nematodes.
Practical: Studies on embryogenesis and post-embryogenesis, hatching, moultng, life cycle development, feeding, enzymatic assay by electrophoresis.

Nem. 508 Nematode Ecology 1+1 Sem.II
Practical: Study of nematode fauna in varied agro-ecological systems, community analysis of nematode populations, laboratory exercises on influence of abiotic factors on movement and hatching, green-house experiments on effect of abiotic factors on nematode populations and plant growth. Pathogenicity of nematodes alone or in association with other organisms.

Nem. 509/Ent.509/Pl.Path.509 Molecular Approaches in Plant Protection 2+1 Sem.II

Nem. 510/Ent.510/Pl.Path.510 Quarantine in Plant Protection 2+0 Sem.II

Nem.511 Nematode Interaction with Other Organisms 1+1 Sem.II
Concept of interaction, its importance in disease complexes and their management involving nematode and other organisms. Interaction of plant parasitic nematodes with wilt causing fungal pathogens. Interaction of plant parasitic nematodes with root rot and other fungal pathogens. Interaction of plant parasitic
nematodes with bacterial pathogens, other nematodes and arthropods. Virus transmission by nematodes. Practical: Green-house experiments to study the role of plant parasitic nematodes in wilt or rot causing fungal and bacterial pathogens.

**Nem. 512 Beneficial Nematodes**

Beneficial nematode fauna, predators, parasites of insects, molluscs and other pests; Entomophilic nematodes, their important groups and types of associations. Taxonomic characteristics of nematode parasites of insects. Host-parasite relations and life cycle of mermithids, entaphelenchids, thelastomids, sphaerularids and tylenchids. Steinernema and Heterorhabditis, their morphological characteristics, taxonomic status, biology and mode of action. Entomopathogenic nematodes- mass multiplication techniques, formulations, field applications and efficacy, and commercial products. Nematodes as biological models and as indicators of pollution. Role of nematodes in organic matter recycling.

Practical: Isolation, identification, mass rearing and application methods of entomopathogenic nematodes. Evaluating in vitro survival and on other culture media

**Nem. 591 Seminar**

**Nem. 600 Master's Research**
SOIL SCIENCE

PROGRAMMES
1. M.Sc.
2. Ph.D.

COURSE REQUIREMENTS

M.Sc.
Field of Specialization
Pedology, Soil Chemistry, Soil Conservation, Soil Fertility, Soil Microbiology, Soil Physics

Required Courses
Soils 501, Soils 502, Soils 503, Soils 504, Soils 505,

Supporting Courses
Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to special interest and research problem

Minor Fields
Agronomy, Biochemistry, Botany, Chemistry, Microbiology, Soil and Water Engineering, Vegetable Science or any other as approved by Dean, postgraduate Studies

Deficiency courses for students with elective
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Minor Fields
Agronomy, Biochemistry, Botany, Chemistry, Microbiology, Soil and Water Engineering, Vegetable Science or any other as approved by Dean, postgraduate Studies

Deficiency Courses for students with M.Sc. (Agri.)
Soils 501, Soils 502, Soils 503, Soils 504, Soils 505 and other courses as recommended by Student's Advisory Committee in a discipline other than Soil Science

Ph.D.
Field of Specialization
Pedology, Soil Chemistry, Soil Conservation, Soil Fertility, Soil Microbiology, Soil Physics

Required Courses
Soils 601, Soils 602, Soils 603

Supporting Courses
Courses from subject matter fields (other than minor) relating to area of special interest and research problem

Minor Fields
Agronomy, Biochemistry, Botany, Chemistry, Microbiology, Soil and Water Engineering, Vegetable Science or any other as approved by Dean, postgraduate Studies

Deficiency Courses for students with M.Sc. (Agri.)
Soils 501, Soils 502, Soils 503, Soils 504, Soils 505 and other courses as recommended by Student's Advisory Committee in a discipline other than Soil Science

DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses
Soils 91 Soils-I
2+1 Sem.II

Env. 91 Environment-I 3+0 Sem.I

Soils 103 Introduction to Soil Science 2+1 Sem. I

Soils 104 Soil Chemistry, Soil Fertility and Nutrient Management 2+1 Sem. II

Soils 204 Manures and Fertilizers 1+1 Sem. II
Env.301 Environmental Science and Disaster Management 3+0 Sem. I & II

Undergraduate Elective/M.Sc. Supporting/Minor Courses

Soils 433 Soil Survey, Classification and Mapping 0+2 Sem. I

Soils 434 Soil Physical and Biological Environment 1+2 Sem. I

Soils 435 Analytical Techniques in Soils, Plants, Fertilizers and Water 1+3 Sem. I

Postgraduate Courses

Soils 501 Soil Physics 2+1 Sem. I
Soil physical behavior. Soil consistence. Dispersion and workability of soils. Soil compaction and consolidation. Soil strength-bulk density relations. Swelling and shrinkage - basic concepts. Soil structure-


Soils 502 Soil Fertility and Fertilizer Use 2+1 Sem. I

Practical: Laboratory and greenhouse experiments for evaluation of indices of nutrient availability and their critical values in soils and plants. Chemical analysis of soil for total and available nutrients. Analysis of plants for essential elements.

Soils 503 Soil Chemistry 2+1 Sem. I


Soils 504 Soil Mineralogy, Genesis, Classification and Survey 2+1 Sem. II
to respective states. Land capability and land irrigability classification. Land evaluation and land use type. Approaches for managing soils and landscapes in the framework of agro-ecosystem.


Soils 505 Soil Biology and Biochemistry 2+1 Sem. II
(Collaboration: Deptt. of Biochemistry)


Soils 506 Soil Erosion and Conservation 2+1 Sem. II


Soils 507 Geomorphology and Geochemistry 2+0 Sem. I

Soils 508 Soil, Water and Air Pollution 2+1 Sem. II
Practical: Sampling of sewage waters and sludge, industrial wastes, polluted soils and plants. Estimation of dissolved and suspended solids, COD, BOD, nitrate and ammonical N and P, heavy metal content in effluents. Heavy metals in contaminated soils and plants. Air sampling and determination of particulate matter and oxides of S. Visit to various industrial sites to study the impact of pollutants on soil and plants.

Soils 509 Analytical Techniques and Instrumental Methods 1+2 Sem. II
in Soil and Plant Analysis

Soils 510 System Approaches in Soil and Crop Studies 2+0 Sem. I

Soils 511 Management of Problem Soils and Water 2+1 Sem. I
Practical: Characterization of acid, acid sulfate, salt-affected and calcareous soils. Determination of cations (Na+, K+, Ca++, and Mg++) in ground water and soil samples. Determination of anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, CO<sub>3</sub><sup>2-</sup> and HCO<sub>3</sub>−) in ground waters and soil samples. Lime and gypsum requirement of acid and sodic soil.

Soils 601 Advances in Soil Physics 3+0 Sem. II
Soils 602 Advances in Soil Fertility 3+0 Sem. II

Soils 603 Physical Chemistry of Soils 2+0 Sem. I

Soils 604 Soil Genesis and Micropedology 2+0 Sem. I

Soils 605 Biochemistry of Soil Organic Matter 2+0 Sem. I

Soils 606 Land Use Evaluation and Planning 2+0 Sem. II

Soils 591 Seminar
Soils 600 Master’s Research
Soils 700 Ph.D. Research
VEGETABLE SCIENCE

PROGRAMMES
1. M.Sc.
2. Ph.D.

COURSE REQUIREMENTS

M.Sc.
Field of Specialization
Vegetable Breeding, Vegetable Production, Post-harvest Handling
Required Courses
Veg. 501, Veg. 502, Veg. 503, Veg. 504, Veg. 505
Supporting Courses
Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to the area of special interest and research problem.
Minor Fields
Plant Breeding and Genetics, Biotechnology, Botany, Agronomy, Horticulture, Soil Science or any other as approved by Dean, postgraduate Studies.
Deficiency courses for students with elective other than Horticulture
9-12 credit hours of at least 400 series courses as recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.
Field of Specialization
Vegetable Breeding, Vegetable Production Post-harvest Handling
Required Courses
Veg. 601, Veg. 602, Veg. 603
Supporting Courses
Courses from subject matter fields (other than minor) relating to area of special interest and research problem.
Minor Fields
Plant Breeding and Genetics, Biotechnology, Botany, Agronomy, Horticulture, Soil Science or any other as approved by Dean, postgraduate Studies.
Deficiency courses for students with M.Sc.(Agri.) in a discipline other than Vegetable Science
Veg. 501, Veg. 502, Veg. 503, Veg. 504, Veg. 505 and other courses as recommended by Student's Advisory Committee.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Veg. 101 Vegetable Production Technology  

Undergraduate Elective/M.Sc. Supporting/Minor Courses

Veg. 433 Commercial Vegetable Production  

Veg. 434 Vegetable Breeding and Seed Production  

Veg. 435 Forcing Techniques in Vegetable Production  

Postgraduate Courses

Veg. 501 Production Technology of Winter Season Vegetable Crops 2+1 Sem. I
Introduction, nutritional value, origin, botany and taxonomy, important countries and states growing vegetables along with area, climate and soil requirements, commercial varieties/hybrids evolved by private and public sector, sowing/ transplanting time, seed rate and seed treatment, nutritional and irrigation requirements, chemical weed control, mulching, physiological disorders, harvesting techniques, post-harvest management, plant protection measures and seed production of potato, cole crops; cabbage, cauliflower, knol khol, broccoli, brussels' sprout, chinese cabbage, root crops; carrot, radish, turnip, beet root, bulb crops; onion and garlic, peas and beans, green leafy cool season vegetables.

Veg. 502 Production Technology of Summer Season Vegetable Crops 2+1 Sem. II
Introduction, nutritional value, origin, botany and taxonomy, important countries and states growing vegetables along with area, climate and soil requirements, commercial varieties/hybrids evolved by private and public sector, sowing/ transplanting time, seed rate, seed treatment, nutritional and irrigation requirements, chemical weed control, mulching, physiological disorders, harvesting techniques, post-harvest management, plant protection measures and seed production of warm season vegetable crops i.e. solanaceous crops, okra, cucurbitaceous crops, cowpea, sweet potato, cluster beans, amaranth, basella, kang-kong, tapioca. Poly-house, net-house and low tunnel technology for off-season production of summer vegetables.

Veg. 503 Breeding of Self Pollinated and Vegetatively Propagated Vegetable Crops 2+1 Sem. II
History of vegetable breeding. Origin, botany, taxonomy, cytogenetic, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), resistance breeding for biotic and abiotic stress, quality improvement in self-pollinated crops viz. tomato, brinjal, cowpea, pea, beans, okra, salad crops and asexually propagated crops like potato, sweet potato, colocasia and tapioca. Molecular marker, marker assisted breeding and QTLs, biotechnology and their use in breeding in self pollinated and vegetatively propagated vegetable crops. Issue of patenting, PPV & FRA. Concept of ideotypes. Present status of varietal/hybrid development in India. New approaches in breeding of self pollinated vegetables.
Practical: Selection of desirable plants from breeding population. Observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations. Induction of flowering. Selfing and crossing techniques in vegetable crops. Hybrid seed production of vegetable crops in bulk. Screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops. Demonstration of sib-mating and mixed population. Molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.

Veg. 504 Breeding of Cross Pollinated Vegetable Crops 2+1 Sem. I
History of vegetable breeding. Origin, botany, taxonomy, cytogenetic, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), quality improvement, in cross-pollinated crops viz. capsicum, chilli, cucurbits (muskmelon, watermelon, cucumber, bottle gourd, long
melon, bitter gourd, sponge gourd, summer squash), cole crops (cabbage, cauliflower, broccoli, brussels' sprouts), root crops (carrot radish, turnip), bulb crops (onion, garlic), asparagus, leafy vegetables and spices (black pepper, turmeric, cardamom, coriander). Molecular marker, marker assisted breeding and QTLs, biotechnology and their use in breeding cross pollinated vegetable crops. Present status of varietal/ hybrid development in India. New approaches in breeding of cross pollinated vegetables.


Veg. 505 Systematics of Vegetable Crops
2+1 Sem. I
Principles of classification, different methods of classification, salient features of international code of nomenclature of vegetable crops. Origin, history, evolution and distribution of vegetable crops, botanical description of families, genera and species covering self and cross pollinated vegetable crops viz. brinjal chilli, tomato, muskmelon, water melon, bottle gourd, cucumber, bitter gourd, onion, cabbage, cauliflower, carrot, radish, turnip, amaranth, palak, peas, beans, okra and vegetatively propagated vegetables like potato, garlic, sweet potato and spices (turmeric, coriander); cytological level of various vegetable crops, descriptive blanks for describing various varieties of important vegetable crops.


Veg. 506 Seed Production Technology of Vegetable Crops
2+1 Sem. I
Definition of seed and its quality; DUS test, scope of vegetable seed industry in India. Agronomical principles and methods of seed production in important vegetable crops; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production. Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control. Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology.

Practical: Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, germination, physical purity) and seed health testing. Notification procedures of varieties. Floral biology. Rouging off-types. Methods of hybrid seed production in important vegetable crops. Seed extraction techniques. Handling of seed processing and seed testing equipments. Visit to seed processing units. Seed testing laboratory and seed production farms.

Veg. 507 Production Technology of Under Exploited Vegetable Crops
2+0 Sem. I
Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed production of asparagus, artichoke, leek, brussels sprout, chinese cabbage, broccoli, kale, amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathu (chenopods), elephant foot, yam, lima bean, winged bean, vegetable pigeon pea, jack bean, sword bean, spine gourd, pointed gourd, oriental pickling melon and little gourd (kundru).

Veg. 508 Organic Vegetable Production Technology
2+1 Sem. II

**Veg. 509 Post-harvest Handling of Vegetable Crops**  
Determination of maturity in different vegetable crops, assessment of post-harvest losses, pre-harvest methods and practices affecting post-harvest shelf life of vegetables, mechanized harvesting of vegetables, pre-cooling of vegetables using different techniques, post-harvest chemical and non-chemical treatments to enhance shelf life, sorting and grading for packaging, ripening of vegetables, packaging of vegetables including latest techniques like MAP, storage of vegetables including latest techniques like CA storage, food safety and quality, non-destructive methods of quality analysis, quality of raw material for processing, transportation and destination handling, marketing, treatments before shipment and storage, fresh-cut vegetables.


**Veg. 601 Advances in Vegetable Production**  

**Veg. 602 Advances in Vegetable Breeding**  
Evolution, distribution, cytogenetic, genetic resources, genetic divergence, types of pollination and fertilization mechanisms, sterility and incompatibility, anthesis and pollination, hybridization, inter-varietal, inter-specific and inter-genetic hybridization, heterosis breeding, inheritance pattern of traits, qualitative and quantitative, plant type concept and selection indices, genetics of spontaneous and induced mutations, problems and achievements of mutation breeding, ploidy breeding and its achievements, in vitro breeding; breeding techniques for improving quality and processing characters; breeding for stresses, mechanism and genetics of resistance, breeding for salt, drought; low and high temperature; toxicity and water logging resistance, breeding for insect pests, disease, nematode and multiple resistance of Tomato, brinjal, chilli, sweet pepper and potato; cucurbits, cabbage, cauliflower and knol-khol, bhindi, onion, peas, beans, amaranthus, drumstick, carrot, beet root, radish, sweet potato tapioca, elephant foot yam and taro.

**Veg. 603 Laboratory Techniques in Vegetable Crops**  
Use of laboratory equipments for determining the various bio-chemical constituents. Principles and procedures for determination of various biochemical constituents including protein, ascorbic acid, dry matter, colouring matter, beta carotene, lycopene, oleoresin content, capsaicin, sugars (total and reducing), chlorophyll, chromatography, electrophoresis and determination of enzymes relevant to post-harvest handling and processing.

Practical: Determination of sugars (reducing and non-reducing), protein, capsaicin, ascorbic acid, titrable acidity, phenols, O-dihydroxy phenols, carotene and pigments, dry matter, colour, lycopene, colouring matter, texture, oleoresin content, TSS, flavonols, chromatography including TLC, GLC, column chromatography. Electrophoresis, PCR and isolation of plant DNA. Respiration and ethylene measurements.

**Veg. 604 Abiotic Stress Management in Vegetable Crops**  
Environmental stress and its types, soil parameters including pH, classification of vegetable crops based on susceptibility and tolerance to various types of stresses, root stock, use of wild species, use of
anti-transpirant. Mechanism and measurements of tolerance to drought, water logging, soil salinity, frost and heat stress in vegetable crops; Soil-plant-water relations under different stress conditions in vegetable crops production and their management practices. Techniques of vegetable growing under water deficit, water logging, salinity and sodicity. Techniques of vegetable growing under high and low temperature conditions, use of chemicals in alleviation of different stresses.

Practical: Identification of susceptibility and tolerance symptoms to various types of stress in vegetable crops. Measurement of tolerance to various stresses in vegetable crops. Short term experiments on growing vegetable under water deficit, water-logging, salinity and sodicity, high and low temperature conditions and use of chemicals for alleviation of different stresses.

**Veg. 605 Seed Certification, Processing and Storage of Vegetable Crops 2+1 Sem. I**

Seed certification, objectives, organization of seed certification, minimum seed certification standards, field inspection, specification for certification; Seed processing, study of seed processing equipments seed cleaning and upgrading, seed packing and handling, equipment used for packaging of seeds, procedures for allocating lot number; Pre-conditioning, seed treatment, benefits, types and products, general principles of seed storage, advances in methods of storage, quality control in storage, storage containers, seed longevity and deterioration, sanitation, temperature and relative humidity control, Seed testing; ISTA rules for testing, moisture, purity, germination, vigor test, seed sampling, seed viability, seed health testing; seed dormancy, factors responsible for dormancy. Seed marketing, demand forecast, economics of seed production; farmers’ rights, seed law enforcement, seed act and seed policy, project formulation on vegetable seed production.

Practical: Seed sampling, purity, moisture testing, seed viability, seed vigour tests, seed health testing, seed cleaning, grading and packaging. Handling of seed testing equipment and processing machines. Seed treatment methods, seed priming and pelleting. Field inspection. Practices in rouging. Seed storage. Isolation distances. Mixing and dividing instruments. Biochemical tests. Visit to seed testing laboratories and processing plants. Visit to warehouse to know about sanitation standards.

**Veg. 591 Seminar**

**Veg. 600 Master's Research**

**Veg. 700 Ph.D. Research**
# COURSE CURRICULUM FOR B.Sc. Agri. (Hons.)
## 4 YEAR PROGRAMME (CORE COURSES)

### DEFICIENCY COURSES

#### BASIC SCIENCES AND HUMANITIES

<table>
<thead>
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<th>For PCM base</th>
<th>Cr. Hrs.</th>
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<tbody>
<tr>
<td>1. Bot. 103</td>
<td>Basic Botany 1 + 1</td>
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<tr>
<td>2. Zoo. 103</td>
<td>Basic Zoology 1 + 1</td>
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<td>2 + 2 = 4</td>
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<th>For PCB base</th>
<th>Cr. Hrs.</th>
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<tr>
<td>1. Math. 104</td>
<td>Basic Mathematics-I 1 + 1</td>
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<tr>
<td>2. Math. 108</td>
<td>Basic Mathematics-II 1 + 1</td>
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#### Regional Language

1. For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level
   - Pbi. 101 Basic Punjabi 0 + 2 (NC)
2. For ICAR nominees and foreign students
   - Pbi. Cul. 101 Punjabi Culture 2 + 0 (NC)

### REQUIRED COURSES

#### BASIC SCIENCES AND HUMANITIES

| 1. Biochem. 201 | Elementary Biochemistry 2 + 1 |
| 2. Bot. 206    | Crop Physiology 2 + 1 |
| 3. Chem. 302   | Chemistry of Agrochemicals, Plant Products and Growth Regulators 1 + 1 |
| 4. Econ. 101   | Principles of Agricultural Economics 2 + 0 |
| 5. Econ. 202   | Production Economics, Farm Management and Agricultural Finance 1 + 1 |
| 6. Econ. 303   | Agricultural Marketing, Trade and Prices 1 + 1 |
| 7. Eng. 102    | Comprehension and Communication Skills in English 1 + 2 |
| 8. Micro. 101  | Elementary Microbiology 2 + 1 |
| 9. Mgt. 303    | Fundamentals of Agri-business Management and Entrepreneurship Development 2 + 0 |
| 10. Stat. 102  | Basic Statistics 1 + 1 |
| 15 + 9 = 24    |          |

#### AGRICULTURAL ENGINEERING AND TECHNOLOGY

| 1. CSE 101 | Introduction to Computer Applications 0 + 2 |
| 2. EST 302 | Renewable Energy 1 + 1 |
| 3. FMP 202 | Farm Power and Machinery 1 + 1 |
| 4. PFE 304 | Protective Cultivation and Post Harvest Technology 1 + 1 |
| 5. SWE 101 | Fundamentals of Soil and Water Conservation Engineering 2 + 1 |
| 5 + 6 = 11 |          |

#### AGRICULTURE

<p>| 1. Agromet. 102 | Introductory Agrometeorology 2 + 1 |</p>
<table>
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<tr>
<th>Course Code</th>
<th>Course Name</th>
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<td>Principles of Agronomy-II (Rabi Crops)</td>
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<td>Introduction to Food Science and Post Harvest Value Addition</td>
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<td>Breeding of Field and Horticultural Crops</td>
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<td>Introduction to Soil Science</td>
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<td>Soil Chemistry, Soil Fertility and Nutrient Management</td>
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<td>Manures and Fertilizers</td>
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<td>Educational Tour</td>
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<td>HOME SCIENCE</td>
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**Total Credits:** 57+53 = 110 + 2 (NC)

**HOME SCIENCE**

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**Total Credits:** 1+1=2
## ELECTIVE SPECIALISED COURSES

### Soil Science, Agronomy and Agroforestry

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<tr>
<td>1. Soils</td>
<td>433</td>
<td>Soil Survey, Classification and Mapping</td>
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<td>434</td>
<td>Soil Physical and Biological Environment</td>
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<td>3. Soils</td>
<td>435</td>
<td>Analytical techniques in Soils, Plants, Fertilizers and Water</td>
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<tr>
<td>4. Agron.</td>
<td>433</td>
<td>Weed Management</td>
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<td>5. Agron.</td>
<td>434</td>
<td>Farming Systems and Sustainable Agriculture</td>
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<td>6. Agron.</td>
<td>435</td>
<td>Production Technology of Spices, Aromatic, Medicinal and Plantation Crops</td>
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<td>7. Forst.</td>
<td>433</td>
<td>Production Technology of Economic Forest Trees</td>
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### Crop Protection

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<tr>
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<td>Apiculture</td>
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<td>2. Ent.</td>
<td>434</td>
<td>Biocontrol and Integrated Pest Management</td>
<td>2+2</td>
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<td>435</td>
<td>Pesticides and Plant Protection Equipment</td>
<td>2+1</td>
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<td>4. Pl. Path.</td>
<td>433</td>
<td>Plant Disease Diagnosis</td>
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<td>5. Pl. Path.</td>
<td>434</td>
<td>Biocontrol and Integrated Disease Management</td>
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<td>6. Pl. Path.</td>
<td>435</td>
<td>Post Harvest Diseases and their Management</td>
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<td>7. Nem.</td>
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<td>Plant Nematology</td>
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### Horticulture

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<td>1. Hort.</td>
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<td>Nursery Management of Horticultural Crops</td>
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<td>2. Hort.</td>
<td>434</td>
<td>Commercial Fruit Production</td>
<td>2+1</td>
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<tr>
<td>3. Hort.</td>
<td>435</td>
<td>Processing and Value Addition of Horticultural Crops</td>
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<td>4. Veg.</td>
<td>433</td>
<td>Commercial Vegetable Production</td>
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<tr>
<td>5. Veg.</td>
<td>434</td>
<td>Vegetable Breeding and Seed Production</td>
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<td>6. Veg.</td>
<td>435</td>
<td>Forcing Techniques in Vegetable Production</td>
<td>2+1</td>
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<td>7. Flori.</td>
<td>433</td>
<td>Commercial Floriculture and Landscaping</td>
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### Plant Breeding, Genetics and Biotechnology

<table>
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<td>Genetics of Crop Plants</td>
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<td>434</td>
<td>Cytogenetics of Crop Plants</td>
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<td>3. PBG</td>
<td>435</td>
<td>Theory and Practice of Plant Breeding</td>
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<td>4. PBG</td>
<td>436</td>
<td>Breeding of Field Crops</td>
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<td>5. PBG</td>
<td>437</td>
<td>Crop Experimentation</td>
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<td>433</td>
<td>Principles and Procedures of Plant Tissue Culture and Transformation</td>
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<td>7. Biotech.</td>
<td>434</td>
<td>Principles and Procedures of Molecular Biotechnology and Genomics</td>
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### Post Harvest Technology and Value Addition

<table>
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<td>Fundamentals of Food Biochemistry</td>
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<td>433</td>
<td>Fruit and Vegetable Technology</td>
<td>2+1</td>
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<td>434</td>
<td>Dairy Technology</td>
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<td>4. FT</td>
<td>435</td>
<td>Cereal Technology</td>
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5. FT 436  Egg and Meat Technology  2+1
6. Micro. 433  Fundamentals of Food Microbiology  2+1
7. PFE 433  Engineering Principles in Food Processing  3+1

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<th>Code</th>
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<td>Micro.</td>
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<td>PFE</td>
<td>433</td>
<td>Engineering Principles in Food Processing</td>
<td>3+1</td>
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\[15+6=21\]

**Agricultural Extension, Economics and Business Management**

1. Ext. 433  Visual and Graphic Communication  1+1
2. Ext. 434  Communication and Information Technology  2+1
3. Ext. 435  Behavioural Skills for Human Resource Development  2+0
4. Econ. 433  Micro Economic Analysis  3+1
5. Econ. 434  Macro Economic Analysis  3+0
6. Mgt. 433  Financial and Project Management  3+1
7. Mgt. 434  Retailing and Supply Chain Management  3+0

\[17+4=21\]

NCC/NSO/NSS (Three Fold Programme)

1. NCC/NSO/NSS (SEM-I)  0+1 (NC)
2. NCC/NSO/NSS (SEM-II)  0+1 (NC)
3. NCC/NSO/NSS (SEM-III)  0+1 (NC)
4. NCC/NSO/NSS (SEM-IV)  0+1 (NC)

Total Credit Hours requirement for B.Sc. Agri. (Hons.) Programme 172+6 (NC)+2(NC)*

* Students opting for Pbi. 101/Pbi. Cul. 101

**SEMESTER-WISE STUDY PROGRAMME OF B.Sc. Agri. (Hons.) 4 YEAR PROGRAMME**

**FIRST YEAR**

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<td>3. Micro.</td>
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<td>103</td>
<td></td>
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<td>5. Pbi /</td>
<td>101</td>
<td>0+2 (NC)*</td>
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<td>Pbi. Cul.</td>
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\[12+8=20+1(NC)\]

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\[13+9=22+1(NC)\]
## SECOND YEAR

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## THIRD YEAR

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<td>7. Forst. 301 1+1</td>
<td>7. PBG 304 2+1</td>
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<td>8. PFE 304 1+1</td>
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<td>9. PBG 303 2+1</td>
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## FOURTH YEAR

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<td>1. Elective 21 (Elective Specialized Courses)</td>
<td>1. RAWEP AND ELP 0+20</td>
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<td>2. Biotech. 312 2+1</td>
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<td>ii) ELP 401 0+12</td>
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<td>iii) ELP 402 0+4</td>
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<td>iv) ELP 403 0+1</td>
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### SEMESTER VIII. RAWEP-CUM-EXPERIENTIAL LEARNING PROGRAMME
(20 WEEKS PERIOD, 20 CREDIT HOURS:0+20)

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<th>ELP 401. Specialized Experiential Learning Programme - Elective-wise Experiential Learning Programme (ELP) Modules’</th>
<th>ELP 402. Industrial Attachment (Off-Campus) (0+4) 4 weeks</th>
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<td><strong>ELP 401-based ‘Experiential Learning Programme (ELP)’ Modules’:</strong></td>
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<td><strong>On-Campus</strong> (0+12) 12 weeks</td>
<td>(i) Fertilizer industries (IFFCO, KRIBHCO, NFL, etc.)</td>
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<tr>
<td><strong>Elective-wise ‘Experiential Learning Programme (ELP) Modules’:</strong></td>
<td>(ii) Vermicompost units</td>
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<td><strong>1. Elective: Soils, Agronomy and Agroforestry</strong></td>
<td>(iii) Biofertilizer units</td>
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<tr>
<td>Module for evaluating soil health and irrigation water quality (Deptt. of Soil Science)</td>
<td>(iv) Mineral mines</td>
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<td>Practical seed production (Deptt. of Agronomy)</td>
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<tr>
<td>Nursery production of important agro-forestry tree species (Deptt. of Forestry and Natural Resources)</td>
<td>(i) Plywood manufacturing industries</td>
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<tr>
<td>(On-Campus) (0+4) 4 weeks</td>
<td>(ii) Hi-tech industry (tree planting stock production)</td>
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<td><strong>2. Elective: Crop Protection</strong></td>
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<tr>
<td>Production of bioagents against plant pathogens (i) Pesticide and biopesticide industries (Dept. of Plant Pathology)</td>
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<tr>
<td>Production of important parasitoids and arthropod predators as bioagents against insect-pests of important field crops (Dept. of Entomology)</td>
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<tr>
<td>Commercial apiculture (Deptt. of Entomology)</td>
<td>(i) Sericulture units</td>
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<td>Nursery production of fruit crops (i) Commercial fruit nurseries (Dept. of Fruit Science)</td>
<td>(ii) Commercial honey production, hive and other</td>
</tr>
<tr>
<td>Nursery raising techniques and protected cultivation of vegetables (Dept. of Vegetable Science)</td>
<td>apicultural equipment and honey processing plant</td>
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<td>Nursery raising of flowers and ornamental plants (i) Commercial flower nurseries (Dept. of Floriculture and Landscaping)</td>
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<tr>
<td>Mushroom production (Deptt. of Microbiology)</td>
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<td>(On-Campus) (0+12) 12 weeks</td>
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<td><strong>Title of Module</strong></td>
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</tr>
<tr>
<td><strong>On-Campus</strong> (0+12) 12 weeks</td>
<td></td>
</tr>
<tr>
<td><strong>Elective-wise ‘Experiential Learning Programme (ELP) Modules’:</strong></td>
<td></td>
</tr>
<tr>
<td>(Off-Campus) (0+4) 4 weeks</td>
<td></td>
</tr>
<tr>
<td>(i) Seed industries / companies</td>
<td></td>
</tr>
<tr>
<td>(ii) Mentha distillation plants</td>
<td></td>
</tr>
<tr>
<td>(iii) Herbicide formulators</td>
<td></td>
</tr>
<tr>
<td>(iv) Soybean processing units</td>
<td></td>
</tr>
<tr>
<td>(v) Mineral mines</td>
<td></td>
</tr>
<tr>
<td>(i) Fertilizer industries (IFFCO, KRIBHCO, NFL, etc.)</td>
<td></td>
</tr>
<tr>
<td>(ii) Vermicompost units</td>
<td></td>
</tr>
<tr>
<td>(iii) Biofertilizer units</td>
<td></td>
</tr>
<tr>
<td>(iv) Mineral mines</td>
<td></td>
</tr>
<tr>
<td>(v) Mineral mines</td>
<td></td>
</tr>
</tbody>
</table>
4. Elective: Plant Breeding, Genetics and Biotechnology
Hybrid seed production of sunflower
(Deptt. of Plant Breeding and Genetics)

(i) Commercial hybrid seed production units
(ii) Hybrid seed production units at University Seed Farms (Naraingarh, Nabha, Kapurthala, Faridkot and Ladhowal)

Biotechnological tools in crop improvement
(School of Agricultural Biotechnology)

(i) Biotechnological industries and tissue culture labs

5. Elective: Post Harvest Technology and Value Addition
Production of value added processed food products
(Deptt. of Food Science and Technology)

(i) Food processing and packaging industries

Designing and preparation of facilitating material and organizing activities
(Deptt. of Extension Education)

(i) Non-governmental organizations and SHGs to study their mandate, activities and problems, etc. and extension services provided by CAO, Deputy Director (Horticulture), Soil Conservation, PAMEITI, ATMA, IFFCO, KRIBHCO, MARKFED, DRDA, Zila Parishad, etc.

Marketing of agricultural produce, preparing enterprise & financial budgets and identification of adoption gaps
(Deptt. of Agric. Economics and Sociology)

(ii) Agricultural Financial Institutions / branches of Commercial Banks / Co-operative Banks, Co-operative Agricultural Service Societies (CASS), market committees

Case studies related to financial, project, retail and supply chain management, and preparation of project profile
(School of Business Studies)

(iii) Agri-business industry in Public/ Private sector to study Agri-business Management practices/processes

Students opting for a particular elective programme will opt for any one module i.e. ELP 401 within the elective and will opt for only one corresponding module, as listed under ELP 402.

ELP 403. Documentation, Report Presentation and Evaluation (On-Campus) (0+1) 1 week, based on corresponding ELP 401 & ELP 402.

RAWE P : 13 Credit hours
Elective : 21 Credit hours
ELP : 17 Credit hours
I. **RAWE Courses/ RAWEP**

**Semester I.**
NCC/NSO/NSS: 1 Credit hour (0+1 NC)

**Semester II.**
NCC/NSO/NSS: 1 Credit hour (0+1 NC)

**Semester III.**
NCC/NSO/NSS: 1 Credit hour (0+1 NC)

**Semester IV.**
NCC/NSO/NSS: 1 Credit hour (0+1 NC)

**Semester V.**
Agron. 301: Practical Crop Production -I (*Kharif Crops*): 2 Credit hours (0+2)
Edu. Tour: Educational Tour: 2 Credit hours (0+2 NC)

**Semester VI.**
Agron. 302. Practical Crop Production -II (*Rabi Crops*): 2 Credit hours (0+2)

**Semester VII.**
Elective courses: 21 Credit hours

**Semester VIII.**
RAWE 401: 'Village Attachment': 3 weeks, 3 Credit hours (0+3)

I. **Rural Awareness Work Experience**
RAWE 401: 'Village Attachment': 3 weeks, 3 Credit hours (0+3) (Coordinator: Head, Department of Extension Education)

II. **Experiential Learning Programme**
ELP 401: 'Specialized Experiential Learning Programme - TITLE OF ELECTIVE ELP***: 12 weeks, 12 Credit hours, On-campus activity (0+12)
ELP 402: 'Industrial Attachment': 4 weeks, 4 Credit hours, Off-campus activity (0+4)
ELP 403: 'Documentation and Report Presentation & Evaluation', 1 week, 1 Credit hour (0+1)
TOTAL CREDIT HOURS REQUIREMENT FOR B.Sc. Agri. (Hons.) PROGRAMME 172+ 6 (NC)+2(NC)*

* Students opting for Pbi. 101/Pbi. Cul. 101
** Students have to fill the appropriate title in their Registration Cards
COURSE CURRICULUM FOR B.Sc. Agri. (Hons.) 6 YEAR PROGRAMME
FOR FIRST TWO YEARS

CORE COURSES

BASIC SCIENCES AND HUMANITIES

1. Bot. 91 Botany-I 3+1
2. Bot. 92 Botany-II 3+1
3. Chem.91 Chemistry-I 3+1
4. Chem.92 Chemistry-II 3+1
5. Eng. 91 English-I 2+1
6. Eng. 92 English-II 2+1
7. Pbi. 91 Punjabi-I 2+1
8. Pbi. 92 Punjabi-II 2+1
9. Phys. 91 Physics-I 3+1
10. Phys. 92 Physics-II 3+1
11. Zoo. 91 Zoology-I 3+1
12. Zoo. 92 Zoology-II 3+1

AGRICULTURE

1. Agron. 91 Agronomy-I 2+1
2. Env. 91 Environment-I 3+0
3. Ent - Pl.Path. 91 Plant Protection-I 2+1
4. Ext. 91 Extension-I 2+0
5. Hort. 91 Horticulture-I 2+1
6. LPM. 91 Animal Science-I 2+1
7. Ort. 91 Orientation 0+1(NC)
8. PFT 91 Practical Field Training-I 0+1
9. PFT 92 Practical Field Training-II 0+1
10. Soils 91 Soils-I 2+1

NCC/NSO/NSS

1. NCC/NSO/NSS (SEM-I) 0+1 (NC)
2. NCC/ NSO/NSS (SEM-II) 0+1 (NC)
3. NCC/NSO/NSS (SEM-III) 0+1 (NC)
4. NCC/NSO/NSS (SEM-IV) 0+1 (NC)

Note:

1. All courses approved for B.Sc. Agri. (Hons.) 4-year Programme by Academic Council will also be applicable to B.Sc. Agri. (Hons.) 6-year Programme from 3rd year onwards
2. However, the students of B.Sc. Agri. (Hons.) 6-year programme will be exempted from:
   (a) NCC/NSO/NSS (0+1NC), which they have already cleared during initial two years,
   (b) Pbi. 101 (0+2NC), Bot 103 (1+1) and Zoo 103 (1+1) courses, because they have already cleared 6 credit hours in Punjabi (Pbi. 91 and Pbi. 92) and 8 credit hours each in Botany (Bot. 91 and Bot. 92) and Zoology (Zoo. 91 and Zoo. 92) during initial two years which are equivalent to 10+2 medical stream.

32+12=44

15+7=22 +1(NC)
3. The students who join 3rd year of B.Sc. Agri. (Hons.) 6-year Programme after completion of 2-Year Certificate Course in Agriculture will be exempted from:

(a) Agromet. 102 (2+1), Agron.106 (2+1), Pl. Path. 101 (2+1) and Soils 103 (2+1) courses, which they have already cleared during '2-Year Certificate Course in Agriculture'

(b) Pbi. 101 (0+2NC), Bot. 103 (1+1) and Zoo. 103 (1+1) courses, because they have already cleared 6 credit hours in Punjabi (Pbi. 91 and Pbi. 92) and 8 credit hours each in Botany (Bot.91 and Bot. 92) and Zoology (Zoo. 91 and Zoo. 92) during initial two years which are equivalent to 10+2 medical stream.

4. The students who join 3rd year of B.Sc. Agri. (Hons.) 6-year Programme after completion of '2-Year Certificate Course in Agriculture' will take Chem. 91 (3+1), Chem. 92 (3+1), Phys. 91 (3+1), Phys. 92 (3+1) and NCC/NSO/NSS (0+1) courses, which are not included in the Course Curriculum of '2-Year Certificate Course in Agriculture' programme.

**SEMESTER-WISE STUDY PROGRAMME OF B.Sc. Agri. (Hons.) 6-YEAR PROGRAMME FOR FIRST TWO YEARS**

**FIRST YEAR**

<table>
<thead>
<tr>
<th>SEM I</th>
<th>SEM II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Agron.</td>
<td>91</td>
</tr>
<tr>
<td>2. Bot.</td>
<td>91</td>
</tr>
<tr>
<td>3. Chem.</td>
<td>91</td>
</tr>
<tr>
<td>4. Eng.</td>
<td>91</td>
</tr>
<tr>
<td>5. Ort.</td>
<td>91</td>
</tr>
<tr>
<td>6. Pbi.</td>
<td>91</td>
</tr>
<tr>
<td>7. NCC/NSO /NSS</td>
<td>0+1(NC)</td>
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</tbody>
</table>

**SECOND YEAR**

<table>
<thead>
<tr>
<th>SEM III</th>
<th>SEM IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Env.</td>
<td>91</td>
</tr>
<tr>
<td>2. Hort.</td>
<td>91</td>
</tr>
<tr>
<td>3. LPM</td>
<td>91</td>
</tr>
<tr>
<td>4. Phys.</td>
<td>92</td>
</tr>
<tr>
<td>5. Ent.-Pl.Path.</td>
<td>91</td>
</tr>
<tr>
<td>6. PFT</td>
<td>91</td>
</tr>
<tr>
<td>7. NCC/NSO /NSS</td>
<td>0+1(NC)</td>
</tr>
</tbody>
</table>

**Note:**
1. All courses approved for B.Sc. Agri. (Hons.) 4-year Programme by Academic Council will also be applicable to B.Sc. Agri. (Hons.) 6-year Programme from 3rd year onwards
2. However, the students of B.Sc. Agri. (Hons.) 6-year programme will be exempted from: NCC/NSO/NSS (0+1NC), which they have already cleared during initial two years. The students will also be exempted from Pbi. 101 (0+2NC), Bot 103 (1+1) and Zoo 103 (1+1) courses, because they have already cleared 6 credit.
3. 10A Bathinda and Gurdaspur students will register for three fold programme during then 3rd and 4th at PAU Ludhiana campus.
COURSE CURRICULUM FOR B.Tech. FOOD TECHNOLOGY
4 YEAR PROGRAMME (CORE COURSES)

DEFICIENCY COURSES

BASIC SCIENCES AND HUMANITIES

For PCM base

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Th + Pr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bot.</td>
<td>103</td>
<td>Basic Botany</td>
<td>1 + 1</td>
</tr>
<tr>
<td>2. Zoo.</td>
<td>103</td>
<td>Basic Zoology</td>
<td>1 + 1</td>
</tr>
</tbody>
</table>

For PCB base

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Th + Pr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Math.</td>
<td>104</td>
<td>Basic Mathematics-I</td>
<td>1 + 1</td>
</tr>
<tr>
<td>2. Math.</td>
<td>108</td>
<td>Basic Mathematics-II</td>
<td>1 + 1</td>
</tr>
</tbody>
</table>

Regional Language

1. For students with domicile of Punjab who have not taken Punjabi at Matric/ 10+2 level
   Pbi. | 101 | Basic Punjabi | 0 + 2 (NC) |
2. For ICAR nominees and foreign student
   Pbi. Cul. | 101 | Punjabi Culture | 2 + 0 (NC) |

REQUIRED COURSES

BASIC SCIENCES AND HUMANITIES

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Th + Pr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Biochem.</td>
<td>201</td>
<td>Elementary Biochemistry</td>
<td>2+1</td>
</tr>
<tr>
<td>2. Biochem.</td>
<td>424</td>
<td>Experiments in Biochemistry</td>
<td>0+3</td>
</tr>
<tr>
<td>3. Biochem.</td>
<td>428</td>
<td>Fundamentals of Food Biochemistry</td>
<td>2+0</td>
</tr>
<tr>
<td>4. Econ.</td>
<td>101</td>
<td>Principles of Agricultural Economics</td>
<td>2+0</td>
</tr>
<tr>
<td>5. Econ.</td>
<td>303</td>
<td>Agricultural Marketing, Trade and Prices</td>
<td>1+1</td>
</tr>
<tr>
<td>6. Econ.</td>
<td>428</td>
<td>Practices in Project Planning and Evaluation</td>
<td>0+3</td>
</tr>
<tr>
<td>7. Eng.</td>
<td>102</td>
<td>Comprehension and Communication Skills in English</td>
<td>1+2</td>
</tr>
<tr>
<td>8. Math.</td>
<td>211</td>
<td>Engineering Mathematics-I</td>
<td>2+1</td>
</tr>
<tr>
<td>9. Math.</td>
<td>212</td>
<td>Engineering Mathematics-II</td>
<td>2+1</td>
</tr>
<tr>
<td>10. Mgt.</td>
<td>303</td>
<td>Fundamentals of Agribusiness Management and Entrepreneurship Development</td>
<td>3+0</td>
</tr>
<tr>
<td>11. Mgt.</td>
<td>423</td>
<td>Introduction to Entrepreneurship and Marketing</td>
<td>2+1</td>
</tr>
<tr>
<td>12. Micro.</td>
<td>101</td>
<td>Elementary Microbiology</td>
<td>2+1</td>
</tr>
<tr>
<td>13. Micro.</td>
<td>424</td>
<td>Fermentation and Industrial Microbiology</td>
<td>2+1</td>
</tr>
<tr>
<td>14. Micro.</td>
<td>433</td>
<td>Fundamentals of Food Microbiology</td>
<td>2+1</td>
</tr>
<tr>
<td>15. Stat.</td>
<td>102</td>
<td>Basic Statistics</td>
<td>1+1</td>
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</table>

AGRICULTURE

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Title</th>
<th>Th + Pr</th>
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</thead>
<tbody>
<tr>
<td>1. Agromet.</td>
<td>102</td>
<td>Introductory Agrometeorology</td>
<td>2+1</td>
</tr>
<tr>
<td>2. Agron.</td>
<td>101</td>
<td>Elements of Agronomy</td>
<td>2+1</td>
</tr>
<tr>
<td>3. Biotech.</td>
<td>102</td>
<td>Food Biotechnology</td>
<td>2+1</td>
</tr>
<tr>
<td>4. Ext.</td>
<td>202</td>
<td>Extension Methodologies and Communication Skills for Transfer of Technology</td>
<td>1+1</td>
</tr>
<tr>
<td>5. Env.</td>
<td>301</td>
<td>Environmental Science and Disaster Management</td>
<td>3+0</td>
</tr>
<tr>
<td>6. FT</td>
<td>101</td>
<td>Food Production Trends and Programmes</td>
<td>2+0</td>
</tr>
<tr>
<td>7. FT</td>
<td>102</td>
<td>Principles of Food Processing and Preservation</td>
<td>2+1</td>
</tr>
<tr>
<td>8. FT</td>
<td>201</td>
<td>Technology of Fish and Marine Foods</td>
<td>1+1</td>
</tr>
<tr>
<td></td>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>9.</td>
<td>FT 202</td>
<td>Food Quality</td>
<td>1+1</td>
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<tr>
<td>10.</td>
<td>FT 203</td>
<td>Food Packaging</td>
<td>2+1</td>
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<tr>
<td>11.</td>
<td>FT 204</td>
<td>Technology of Extruded Food Products</td>
<td>2+1</td>
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<tr>
<td>12.</td>
<td>FT 303</td>
<td>Food Additives</td>
<td>2+1</td>
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<tr>
<td>13.</td>
<td>FT 304</td>
<td>Food Industry By-products</td>
<td>1+1</td>
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<tr>
<td>14.</td>
<td>FT 305</td>
<td>Food Safety, Laws and Regulation</td>
<td>2+1</td>
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<tr>
<td>15.</td>
<td>FT 306</td>
<td>Speciality Foods</td>
<td>1+1</td>
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<tr>
<td>16.</td>
<td>FT 307</td>
<td>Technology of Food Beverages</td>
<td>1+1</td>
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<tr>
<td>17.</td>
<td>FT 401</td>
<td>Quality Assurance and Certification</td>
<td>2+1</td>
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<tr>
<td>18.</td>
<td>FT 402</td>
<td>Confectionery and Bakery Technology</td>
<td>2+1</td>
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<tr>
<td>19.</td>
<td>FT 403</td>
<td>Technology of Legumes and Oilseeds</td>
<td>2+1</td>
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<tr>
<td>20.</td>
<td>FT 404</td>
<td>Technology of Plantation Crops and Spices</td>
<td>1+1</td>
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<td>21.</td>
<td>FT 433</td>
<td>Fruit and Vegetable Technology</td>
<td>2+1</td>
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<tr>
<td>22.</td>
<td>FT 434</td>
<td>Dairy Technology</td>
<td>2+1</td>
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<tr>
<td>23.</td>
<td>FT 435</td>
<td>Cereal Technology</td>
<td>2+1</td>
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<tr>
<td>24.</td>
<td>FT 436</td>
<td>Egg and Meat Technology</td>
<td>2+1</td>
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<tr>
<td>25.</td>
<td>FT 491</td>
<td>B.Tech. Seminar</td>
<td>0+1</td>
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<td>26.</td>
<td>FT 499</td>
<td>Industrial Training</td>
<td>0+20</td>
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<td>27.</td>
<td>Hort. 301</td>
<td>Post-harvest Management of Fruits and Vegetables</td>
<td>1+1</td>
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<tr>
<td>28.</td>
<td>Edu. Tour</td>
<td>Educational Tour</td>
<td>0+2( NC)</td>
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</tbody>
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**AGRICULTURAL ENGINEERING & TECHNOLOGY**

1. CSE 101 Introduction to Computer Application 0+2
2. CSE 104 IT Application in Food Industry 1+1
3. EST 302 Renewable Energy 1+1
4. ME 103 Engineering Drawing 0+2
5. ME 106 Thermodynamics 2+0
6. ME 205 Workshop Technology 2+1
7. ME 206 Heat and Mass Transfer 2+0
8. ME 303 Fluid Mechanics 2+1
9. ME 311 Instrumentation and Process Control 2+1
10. PFE 211 Food Processing Equipment-I 2+1
11. PFE 311 Food Processing Equipment-II 2+1
12. PFE 312 Food Plant Design and Layout 1+2
13. PFE 407 Waste and By-Product Utilization 2+1

**HOME SCIENCE**

1. FN 103 Principles of Human Nutrition 2+1
2. HD 106 Human Values in Education 1+1

**NCC/NSO /NSS**

1. NCC/NSO /NSS (SEM-I) 0+1 NC
2. NCC/NSO /NSS (SEM-II) 0+1 NC
3. NCC/NSO /NSS (SEM-III) 0+1 NC
4. NCC/NSO /NSS (SEM-IV) 0+1 NC

Total credit hours requirement for B.Tech. Food Technology 4 year Programme 170+6( NC)+2( NC)*

* Students opting for Pbl. 101/Pbl Cul. 101
**SEMESTER-WISW STUDY PROGRAMME OF**
**B.Tech. FOOD TECHNOLOGY 4 YEAR PROGRAMME**

**FIRST YEAR**

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Credits</th>
<th>Course</th>
<th>Code</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agron.</td>
<td>101</td>
<td>2+1</td>
<td>Micro.</td>
<td>101</td>
<td>2+1</td>
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<tr>
<td>Agromet.</td>
<td>102</td>
<td>2+1</td>
<td>Biochem.</td>
<td>201</td>
<td>2+1</td>
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<td>Eng.</td>
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<td>FN</td>
<td>103</td>
<td>2+1</td>
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<td>101</td>
<td>2+0</td>
<td>FT</td>
<td>102</td>
<td>2+1</td>
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<td>ME</td>
<td>106</td>
<td>2+0</td>
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<tr>
<td>ME</td>
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<td>1+1</td>
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<td>0+2</td>
<td>Bot./</td>
<td>103</td>
<td>1+1</td>
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<tr>
<td>Zoo./</td>
<td>103/</td>
<td>1+1</td>
<td>Math.</td>
<td>108</td>
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<tr>
<td>Math.</td>
<td>104</td>
<td>1+1</td>
<td>Stat.</td>
<td>102</td>
<td>1+1</td>
</tr>
<tr>
<td>Pbi. /</td>
<td>101/</td>
<td>0+2 (NC)*</td>
<td>Stat.</td>
<td>106</td>
<td>1+1</td>
</tr>
<tr>
<td>Pbi. Cul.</td>
<td>101</td>
<td>2+0 (NC)*</td>
<td>NCC/NSO/ NSS</td>
<td>0+1(NC)</td>
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<tr>
<td>NCC/NSO/NSS</td>
<td>0+1 (NC)</td>
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<td>10+9=19+1 (NC)</td>
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**SECOND YEAR**

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
<th>Credits</th>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>EST</td>
<td>302</td>
<td>1+1</td>
<td>FT</td>
<td>203</td>
<td>2+1</td>
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<tr>
<td>Env.</td>
<td>301</td>
<td>3+0</td>
<td>FT</td>
<td>204</td>
<td>2+1</td>
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<tr>
<td>Biotech.</td>
<td>102</td>
<td>2+1</td>
<td>Econ.</td>
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187
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188
COURSE CURRICULUM FOR B.Sc. BIOTECHNOLOGY (Hons.)
4-YEAR PROGRAMME (CORE COURSES)

DEFICIENCY COURSES

BASIC SCIENCES AND HUMANITIES

For PCM base

1. Bot. 103 Basic Botany 1 + 1
2. Zoo 103 General Zoology 1 + 1

For PCB base

1. Math. 104 Basic Mathematics-I 1 + 1
2. Math. 108 Basic Mathematics-II 1 + 1

Regional Language
1. For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level
   Pbi. 101 Basic Punjabi 0 + 2 (NC)
2. For ICAR nominees and foreign student
   Pbi. Cul. 101 Punjabi Culture 2 + 0 (NC)

REQUIRED COURSES

AGRICULTURE
1. Agromet. 102 Introductory Agrometeorology 2 + 1
2. Agron. 101 Elements of Agronomy 2 + 1
3. Biotech. 101 Introduction to Biotechnology 2 + 1
4. Biotech. 301 Fundamentals of Recombinant DNA 3 + 1
5. Biotech. 302 Introduction to Plant Tissue Culture 2 + 1
6. Biotech. 303 Introduction to Nanobiotechnology 2 + 0
7. Biotech. 304/ Micro. 303 Introduction to Industrial Biotechnology 2 + 1
8. Biotech. 305 Introduction to Molecular Biology 2 + 0
9. Biotech. 306 Introduction to Molecular Genetics 2 + 0
10. Biotech. 307 Introduction to Bioinformatics 2 + 1
11. Biotech. 308 Instrumentation in Biotechnology 0 + 2
12. Biotech. 309 Introduction to Cell Biology 2 + 1
13. Biotech. 313 Environmental Biotechnology 2 + 0
14. Biotech. 401 Introduction to Genomics and Proteomics 3 + 0
15. Biotech. 402 Fundamentals of Cytogenetics and Molecular Cytogenetics 2 + 1
16. Biotech. 403 Techniques in Molecular Biology 0 + 2
17. Biotech. 404 Computational Biology 3 + 1
18. Biotech. 406 Funcational Genomics 2 + 0
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<td>In-house Project Training</td>
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<td>22. Ent. 201</td>
<td>Introductory Entomology</td>
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<td>23. Env. 301</td>
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<td>Extension Methodologies and Communication Skills for Transfer of Technology</td>
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<td>25. Flori. 301</td>
<td>Flower Cultivation and Landscape Gardening</td>
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<td>26. Forst. 301</td>
<td>Introductory Forestry</td>
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<td>Introduction to Genetics</td>
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<td>Genetics of Crop Plants</td>
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<td>32. PBG 435</td>
<td>Theory and Practices of Plant Breeding</td>
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<td>Plant Pathogens and Principles of Plant Pathology</td>
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<td>Introduction to Soil Science</td>
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**AGRICULTURAL ENGINEERING AND TECHNOLOGY**

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**BASIC SCIENCES AND HUMANITIES**

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<td>Fundamentals of Biochemistry</td>
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<td>3. Bot. 206</td>
<td>Crop Physiology</td>
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<td>Photosynthesis, Respiration and Metabolism</td>
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<td>Physical and Inorganic Chemistry</td>
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<td>11. Micro. 101</td>
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33+13=46
### HOME SCIENCE

1. **HD** 106 Human Values in Education  
   \[1+1\]
   \[1+1=2\]

### NCC/NSO/NSS

1. NCC/NSO/NSS (SEM-I) \[0+1\] (NC)
2. NCC/NSO/NSS (SEM-II) \[0+1\] (NC)
3. NCC/NSO/NSS (SEM-III) \[0+1\] (NC)
4. NCC/NSO/NSS (SEM-IV) \[0+1\] (NC)

**Total credit hour requirements for B.Sc. Biotechnology (Hons.) 4 year Programme**  
\[170+6\] (NC)+2(NC)*

*Students opting for Pbi. 101/Pbi. Cul. 101*
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192
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193
# Course Curriculum for '2 Year Certificate Course in Agriculture'

## Core Courses
### Basic Sciences and Humanities

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**Total credit hours requirement for "2 Year Certificate Course in Agriculture"**: 20+8=28

## College of Agriculture

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<td>Agromet. 102</td>
<td>Introductory Agrometeorology</td>
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<td>Env. 91</td>
<td>Environment-I</td>
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<td>Plant Protection-I</td>
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<td>Hort. 91</td>
<td>Horticulture-I</td>
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<td>LPM 91</td>
<td>Animal Science-I</td>
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<td>Pl. Path. 101</td>
<td>Plant Pathogens and Principles of Plant Pathology</td>
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<td>Soils 91</td>
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<tr>
<td>Veg. 101</td>
<td>Production Technology of Vegetables</td>
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<td>PFT 91</td>
<td>Practical Field Training-I</td>
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<td>PFT 92</td>
<td>Practical Field Training-II</td>
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<td>Ort. 91</td>
<td>Orientation</td>
<td>0+1(NC)</td>
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**Total credit hours requirement for "2 Year Certificate Course in Agriculture"**: 25+12=37+1(NC)

(Discounted w.e.f. academic session 2013-14)
## COURSE CURRICULUM FOR '2 YEAR CERTIFICATE COURSE IN AGRICULTURE'

### FIRST YEAR

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<tr>
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<th>SEM I</th>
<th>SEM II</th>
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<td>1. Agron.</td>
<td>91 2+1</td>
<td>1. Agron. 106 2+1</td>
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<td>3. Soils</td>
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<td>6. Pbi.</td>
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11+5=16+1(NC)

### SECOND YEAR

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11+5=16

12+5=17

(Discounted w.e.f. academic session 2013-14)