SECTION X

FACULTY OF BASIC SCIENCES AND HUMANITIES

General Information

Disciplines
- Biochemistry
- Botany
- Business Studies
- Chemistry
- Economics and Sociology
- Journalism, Languages and Culture
- Mathematics, Statistics and Physics
- Microbiology
- Zoology

- Course curriculum for Award of 3-year B.Sc. Degree on opting out of 5-year integrated M.Sc. (Hons) Programme in Biochemistry
- Semester-wise Programme for 5-year Integrated M.Sc. (Hons) in Biochemistry
- Course curriculum for Award of 3-year B.Sc. Degree on opting out of 5-year integrated M.Sc. (Hons) Programme in Botany
- Semester-wise Programme for 5-year Integrated M.Sc. (Hons) in Botany
- Course curriculum for Award of 3-year B.Sc. Degree on opting out of 5-year integrated M.Sc. (Hons) Programme in Chemistry
- Semester-wise Programme for 5-year Integrated M.Sc. (Hons) in Chemistry
- Course curriculum for Award of 3-year B.Sc. Degree on opting out of 5-year integrated M.Sc. (Hons) Programme in Microbiology
- Semester-wise Programme for 5-year Integrated M.Sc. (Hons) in Microbiology
- Course curriculum for Award of 3-year B.Sc. Degree on opting out of 5-year integrated M.Sc. (Hons) Programme in Zoology
- Semester-wise Programme for 5-year Integrated M.Sc. (Hons) in Zoology
Basic Sciences provide scientific capital from which practical application of knowledge is drawn. Keeping in view the significance of basic sciences and humanities for proper understanding and development of different areas of agriculture and allied fields, the College of Basic Sciences and Humanities was established in October, 1965. Dr A S Kahlon was the founder Dean of the College and he continued in this position up to October, 1978. Subsequently, Dr Kulbir Singh Gill (December, 1978 to February, 1982; August, 1983 to January, 1986), Dr I S Bhatia (February, 1982 to July, 1983), Dr S S Guraya (January, 1986 to May, 1990), Dr C P Malik (June, 1990 to June, 1994), Dr D R Singh (June, 1994 to July, 1996), Dr H S Garcha (April, 1998 to March, 2000), Dr M.A. Zahir (April, 2000 to December, 2002), Dr A P S Mann (January, 2003 to September, 2005) and Dr Tejwant Singh (October, 2005 to July, 2009) served as Deans of the College. Presently, Dr R S Sidhu is working as the Dean of the College since December, 2009. As a constituent college of the University, the College of Basic Sciences and Humanities strives to be a centre of excellence for advanced studies in the various fields within its jurisdiction.

Its teaching and research objectives are:

i) To impart training and to equip students in basic sciences and humanities (both at UG and PG levels) to provide a scientific base for proper understanding and appreciation of the applied subjects of agriculture, home science and agricultural engineering and technology as well.

ii) To perform integrated functions of resident instruction, research and extension in all the disciplines of basic sciences and humanities.

iii) To promote inter-disciplinary resident instruction, research and extension education programmes at the Punjab Agricultural University.

Before the establishment of PAU, the subjects in basic sciences were taught to B.Sc. (Agri) students by different sections of Govt. Agricultural College, Ludhiana. After the establishment of PAU in 1962, five independent departments (viz., Department of Agricultural Journalism, Languages and Culture; Department of Chemistry and Biochemistry; Department of Economics and Sociology; Department of Genetics and Department of Physics, Mathematics and Statistics) were created in 1963 to teach the subjects of basic sciences and humanities.

The Department of Microbiology was established in the College in 1969. The Department of Business Management was established in 1971 to train students in entrepreneurship and management disciplines. Two more independent departments were established in 1972, viz., Department of Botany by splitting the Department of Botany and Plant Pathology (COA) and Zoology by splitting the Department of Zoology and Entomology (COA). In the same year, an independent Department of Physics was also carved out of combined Department of Physics, Mathematics and Statistics. In 1976, the Department of Chemistry was established by bifurcating the Department of Chemistry and Biochemistry. Keeping in view the role of biotechnology in augmenting agricultural production, an independent Biotechnology Centre was established in 1992 which was merged with Department of Genetics in the year 2000, which has now been shifted to the College of Agriculture. An independent Department of Fisheries was carved out from the Department of Zoology in 1994, which was later shifted to Guru Angad Dev Veterinary and Animal Sciences University in the year 2006. The upgradation of the Department of Business Management to School of Business Studies was done in the year 2012.

At present, the College has eight departments namely, Agricultural Journalism Languages and Culture; Biochemistry; Botany; Chemistry; Economics and Sociology; Mathematics, Statistics and Physics; Microbiology; Zoology and one School i.e. the School of Business Studies. The College is running 27 teaching programmes, which comprise 8 Ph.D., 11 M.Sc., 5 M.Sc.(Hons) Integrated and 1 Diploma in French, in addition to two Certificate Courses, one in French, and the second in Interactive Skills and Personality Enhancement.

The details of various degree courses are given below. The year of start of these programmes is shown in parentheses.
<table>
<thead>
<tr>
<th>Field</th>
<th>Degree(s)</th>
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<tbody>
<tr>
<td>Agricultural Economics</td>
<td>M.Sc. (1963), Ph.D. (1965)</td>
</tr>
<tr>
<td>Business Administration</td>
<td>MBA (1971), Ph.D. (1971)</td>
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<tr>
<td>Business Administration (Agribusiness)</td>
<td>MBA (2004)</td>
</tr>
<tr>
<td>Physics</td>
<td>M.Sc. (2011)</td>
</tr>
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</table>

M.Sc. and Ph.D. programmes in Statistics were started in 1966 and 1968 but discontinued from academic year 1999-2000 and 1998-99, respectively. Ph.D. programme in Physics was started in 1992 but discontinued from the academic session 1998-99. B.Sc. (Hons) programmes in Biochemistry, Botany, Chemistry, Statistics and Zoology were initiated from academic session 1970-71. The programme in Statistics was discontinued from the academic session 1975-76 while the remaining 4 programmes were discontinued from the academic session 1985-86. Total number of students who received B.Sc.(Hons) degree were 366 (Biochemistry-106, Botany-70, Chemistry-96, Statistics-10 and Zoology-84).

The College of Basic Sciences and Humanities has a special role to play in the University because it gives support to all the other Colleges. The College, through its own Board of Studies, approves courses in basic sciences and humanities for all the constituent colleges of the University, as per their needs and requirements. Since students in the College of Agriculture, College of Home Science and College of Agricultural Engineering and Technology are admitted after 10+2, they are deficient in knowledge in some of the basic sciences and the languages. The courses offered by the College, thus, form the scientific base for studying applied courses for the students of these colleges. Many of the courses offered by the various departments of the College are taken by the postgraduate students of different disciplines of the other colleges as minor or supporting courses.

The undergraduate and postgraduate courses offered by the College were revised and updated in the academic year 1982-83. Later on, when the University switched over to semester system in 1988-89, all the courses were again revised/rescheduled and new courses were designed to impart knowledge in Molecular Biology, Genetic Engineering and Biotechnology, Physiology of Plants and Animal and specialized areas in Microbiology including mushroom cultivation. Based on recent advances and changing scenario in sciences, again many of the courses have been revised/modified and new courses added in the academic year 1998-99. New curricula was designed for M.Sc. (Hons) 5 year Integrated programmes in 2008. The entire curriculum for PG courses was restructured again in the year 2010-11 in accordance with the ICAR guidelines.

The College has well equipped centralized facilities such as PG Research Laboratory, Molecular Biology Laboratory and Computer Laboratory to cater to the needs of faculty and research scholars. The College has been recognized for its role through various awards and honours received by the faculty and students over the years. The distinguished awards include Shanti Swaroop Bhatnagar Award, Rafi Ahmed Kidwai Award, Hari Om Trust Ashram Award, Hira Lal Chakraborty Award, Basanti Devi and Amar Chand Award and the RT Doshi Foundation Award. The faculty/students have been nominated/elected fellows of NAAS, FNA, German Academic Exchange (DAAD) Fellowship, Fulbright Nehru Fellowship, Cambridge Nehru Scholarship, Commonwealth Academic Staff Scholarships and others.
## BIOCHEMISTRY

### PROGRAMMES

**M.Sc**

**Ph.D.**

**Five Year Integrated M.Sc. (Hons)**

### COURSE REQUIREMENTS:

#### M.Sc

<table>
<thead>
<tr>
<th>Fields of specialization</th>
<th>Plant Biochemistry, Molecular Biochemistry, Enzymology, Abiotic and Biotic Stress Biochemistry</th>
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</thead>
<tbody>
<tr>
<td>Required courses</td>
<td>Biochem. 501, Biochem. 502, Biochem. 503, Biochem. 504, Biochem. 505, Biochem. 506</td>
</tr>
<tr>
<td>Supporting courses</td>
<td>Stat. 421, PGS 501 and other courses from subject matter fields (other than minor) relating to area of special interest and research problem</td>
</tr>
<tr>
<td>Minor fields</td>
<td>Botany, Microbiology, Food Science and Technology, Plant Breeding and Genetics, Biotechnology or any other as approved by the Dean Post Graduate Studies</td>
</tr>
<tr>
<td>Deficiency courses</td>
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#### Ph.D.

<table>
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<th>Fields of specialization</th>
<th>Plant Biochemistry, Molecular Biochemistry, Enzymology, Abiotic and Biotic Stress Biochemistry</th>
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<tbody>
<tr>
<td>Required courses</td>
<td>Biochem. 601, Biochem. 602</td>
</tr>
<tr>
<td>Supporting courses</td>
<td>Courses from subject matter fields (other than minor) relating to area of special interest and research problem</td>
</tr>
<tr>
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#### Five Year Integrated M.Sc. (Hons)

<table>
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<th>Field of specialization</th>
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</thead>
<tbody>
<tr>
<td>Required courses</td>
<td>All courses listed for semesters I to VI (P-490) and Biochem. 501, Biochem. 502, Biochem. 503, Biochem. 504, Biochem. 505 and Biochem. 506.</td>
</tr>
<tr>
<td>Supporting courses</td>
<td>Stat. 421, PGS 501 and other courses from subject matter field (other than Minor) relating to the area of special interest and research problem</td>
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<tr>
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</table>
DESCRIPTION OF COURSE CONTENTS

Undergraduate courses/Integrated M.Sc. (Hons)

Biochem. 201 Elementary Biochemistry 2+1 Sem. I and II


Biochem. 202 Introductory Biochemistry 2+1 Sem. II


Biochem. 203 Structure and Function of Biomolecules 3+0 Sem. II

Biochem. 204 Metabolism I 2+0 Sem. I

Biochem. 205 Metabolism II 3+0 Sem. I

Biochem. 425 Fundamentals of Plant Biochemistry  

Biochem. 426 Fundamentals of Animal Biochemistry  

Biochem. 427 Fundamentals of Nutritional Biochemistry  

Biochem. 428 Fundamentals of Food Biochemistry  
Biochemistry of food constituents such as water, lipids, proteins, carbohydrates, minerals, vitamins, enzymes, tannins, colouring and flavouring components. Milk and milk products, fruits and vegetables, meat and poultry products, cereals and pulses. Chemistry and rheology of food-stuffs such as fat globules. Dough systems, syrups, juices, jams and jellies. Effect of processing on food constituents. Food standards.

Biochem. 429 Biochemical and Biophysical Techniques  

Biochem. 430 Fundamentals of Enzymology  

Biochem. 431 Fundamentals of Membrane Biochemistry  
Membrane composition and functions. Various models of unit membrane structure. Comparison of membranes of cells and organelles. Distribution of membrane compounds and their role in organization of membrane

Postgraduate Courses

Biochem. 501 General Biochemistry 3+0 Sem. I

Biochem. 502 Intermediary Metabolism 3+0 Sem. II

Biochem. 503 Enzymology 2+0 Sem. I
Enzyme nomenclature and classification. Enzyme compartmentalization in cell organelles. Isolation and purification of enzymes, measurement of enzyme activity. Ribozymes, isozymes, abzymes, enzyme structure, enzyme specificity, active site, active site mapping, mechanism of enzyme catalysis. Cofactors, coenzymes their structure and role, enzyme inhibition and activation, multienzyme complexes, allosteric enzymes and their kinetics, regulation of enzyme activity. Applications of enzymes in chemical and food industry, enzyme immobilization, biosensors and clinical applications of enzymes.

Biochem. 504 Molecular Biochemistry 3+0 Sem. II
Historical development of molecular biology, nucleic acids as genetic material, chemistry and structure of DNA and RNA. Genome organization in prokaryotes and eukaryotes, super coiling. DNA replication, DNA repair, recombination, reverse transcriptase, repetitive and non-repetitive DNA, satellite DNA. Transcription in prokaryotes and eukaryotes process, RNA editing, RNA processing. Genetic code, ribosome structure and function, organization of ribosomal proteins and RNA genes, genetic code, aminoacyl t-RNA synthases, inhibitors of replication, transcription and translation. Translation and post translational modification; protein targeting, nucleases and restriction enzymes, regulation of gene expression in prokaryotes and eukaryotes, molecular mechanism of mutation. DNA sequencing, recombinant DNA technology, different types of vectors, genomic and cDNA library, selection of recombinants, PCR, site directed mutagenesis. Application of recombinant DNA technology.

Biochem. 505 Techniques in Biochemistry 2+0 Sem. I
Chromatographic and electrophoretic methods of separation: Principles and applications of paper, thin layer and HPTLC, gas-liquid chromatography, HPLC and FPLC; paper and gel electrophoresis, different variants of polyacrylamide gel electrophoresis (PAGE) like native and SDS-PAGE, 2D-PAGE, capillary electrophoresis. Spectrophotometry: Principles and applications of UV-Visible, fluorescence, IR and FTIR, Raman, NMR and FTNMR, ESR and X-Ray spectroscopy. Hydrodynamic methods of separation of biomolecules. Viscosity and sedimentation-their principles, variants and applications. Tracer techniques in biology: concept of radioactivity, radioactivity counting methods with principles of different types of counters, concept of $\alpha$, $\beta$ and $\gamma$ emitters, scintillation counters, $\gamma$ rays spectrometers, autoradiography, and application of radioactive tracers in biology, principles and applications of phosphor imager.
Biochem. 506 Practical in Biochemistry 0+3 Sem. I

Biochem. 507 Immunochemistry 2+0 Sem. II
History and scope of immunology, antigens, Adjuvants, immune system, organs, tissues and cells, immunoglobulin's, molecular organization of immunoglobulin. Classes of antibodies, antibody diversity, theories of generation of antibody diversity, vaccine, monoclonal antibodies, polyclonal antibodies, hybridoma, recombinant antibodies, complement system-classical and alternate. Cellular interactions in the immune response, major histocompatibility complex, cell mediated immune response, cytokines. Immunoregulation, immunological tolerance, hypersensitivity, mechanisms of immunity, Innate resistance and specific immunity. Current immunological techniques-ELISA, RIA.

Biochem. 508 Plant Biochemistry 3+0 Sem. I

Biochem. 509 Animal Biochemistry 3+0 Sem. II
Digestion and absorption of food, vitamins detoxification, biochemistry of specialized tissues - connective tissue, skin, muscle, nervous tissue and blood and other body fluids. Water, electrolyte and acid-base balance, biochemistry of respiration, structure, function and mechanism of major trace elements. Hormones of thyroid, hypothalamus, pituitary, pancreas, adrenals and sex hormones. Membrane receptors of hormones signal transduction, biochemistry of reproduction.

Biochem. 510 Food and Nutritional Biochemistry 2+1 Sem. I
Fundamentals of human nutrition, concept of balanced diet, biochemical composition, energy and food value of various food grains (including cereals, pulses, and oilseeds), fruits and vegetables. Physico-chemical, functional and nutritional characteristics of carbohydrates, proteins and fats and their interactions (emulsions, gelation, browning etc.). Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, anti-nutritional factors, biochemistry of post harvest storage. Enzymes in food industry. Effect of cooking, processing and preservation of different food products on nutrients, biochemical aspects of food spoilage, role of lipase and lipoxygenase, oxidative rancidity and antioxidants. Food additives (coloring agents, preservatives etc.), biogenesis of food flavours and aroma, nutritional quality of plant, dairy, poultry and marine products.

Biochem. 601 Advanced Enzymology 3+0 Sem. II
Theory of enzymatic catalysis, specificity, concept of active site and enzyme substrate complex, different
approaches for determining active site amino acids, active site mapping, acid-base and covalent catalysis, factors associated with catalytic efficiency, proximity and orientation, distortion and strain, induced fit hypothesis, mechanism of enzyme reactions. Effect of different factors affecting enzyme activity, transition state theory, enzyme purification, Arrhenius equation, determination of energy of activation, kinetics of pH and temperature and determination of pKa and $\Delta H_{\text{ion}}$ of active site amino acids. Kinetics of bi-substrate reactions, product inhibition and use of competitive inhibitors in the study of substrate binding order. Mechanism determination by radioisotope exchange, kinetics of mixed inhibitions, substrate and product inhibition. Role of enzymes in regulation of metabolism, allosteric enzymes and their kinetics, enzyme engineering, Bi-functional enzymes.

**Biochem. 602 Advanced Molecular Biochemistry**
3+0   Sem. II

**Biochem. 603 Biochemistry of Biotic and Abiotic Stress**
3+0   Sem. I
Plant-pathogen interaction and disease development; molecular mechanisms of fungal and bacterial infection in plants; changes in metabolism, cell wall composition and vascular transport in diseased plants. Plant defense response, antimicrobial molecules; genes for resistance, hypersensitive response and cell death; systemic and acquired resistance. Plant viruses, host-virus interactions, disease induction, virus movement, and host range determination; viroids, pathogen-derived resistance. Biochemical basis of abiotic stresses namely osmotic (drought, salinity), temperature, heavy metals, air and water pollutants, synthesis and functions of proline and glycine betaine in stress tolerance, interaction between biotic and abiotic stresses; stress adaptation. Reactive oxygen species and biotic and abiotic stress, antioxidants, enzymes defense system. Role of calcium, nitric oxide and salicylic acid in plant development. Molecular strategies for imparting tolerance against biotic and abiotic stress.

**Biochem. 604 Current Topics in Biochemistry**
2+0   Sem. II
Advanced topics related to nutrition, metabolism, enzymology, industrial biochemistry, molecular biochemistry, immunology, signal transduction, metabolic engineering and bioprospecting. Any other advance topic of current interest.

**Biochem. 605 Genomics, Proteomics and Metabolomics**
3+0   Sem. I
Protein and nucleic acid sequencing, various methods of sequencing including automated sequencing and microarrays, whole genome sequencing analysis Comparative genomics, functional genomics, transcriptomics, gene identification, gene annotation, pair-wise and multiple alignments, application of genomics, quantitative PCR, SAGE, MPSS, microarray analysis. Proteome technology 2D-PAGE, MSMS, MALDI-TOF, protein microarray, comparative proteomics and structural proteomics. Metabolic pathway engineering, vitamin A engineering in cereals, role of bioinformatics in functional genomics.

**Biochem. 591 Seminar**

**Biochem. 600 Master’s Research**

**Biochem. 700 Ph.D Research**
PROGRAMMES
M.Sc.
Ph.D.
Five Year Integrated M.Sc. (Hons.)

COURSE REQUIREMENTS

M.Sc.

Field of Specialization: Plant Physiology, Biosystematics
Required courses: Bot.501, Bot.502, Bot.503, Bot.504, Bot.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, Horticulture, Microbiology, Plant Breeding and Genetics, Plant Pathology, Vegetable Crops or any other as approved by the Dean Postgraduate Studies.
Deficiency courses: As recommended by the student's Advisory Committee and approved by the Dean, Postgraduates Studies.

Ph.D.

Field of Specialization: Plant Physiology, Biosystematics
Required courses: Bot.601, Bot.602
Supporting Courses: Courses from subject matter fields/other than Minor relating to area of special interest and research problem.
Minor fields: Biochemistry, Biotechnology, Horticulture, Microbiology, Plant Breeding and Genetics, Plant Pathology, Vegetable Crops or any other as approved by the Dean Postgraduate Studies.
Deficiency courses: As recommended by the student's Advisory Committee and approved by the Dean, Postgraduates Studies.

Five Year Integrated M.Sc. (Hons)

Field of Specialization: Plant Physiology, Biosystematics
Required courses: All courses listed for Semester I to VI (P-493) and Bot.501, Bot.502, Bot.503, Bot.504, Bot.505, Bot.591.
Supporting Courses: Stat.421 and other courses from subject matter fields (other than Minor) relating to area of special interest and research problem.
Minor fields: Biochemistry, Biotechnology, Horticulture, Microbiology, Plant Breeding and Genetics, Plant Pathology, Vegetable Crops or any other as approved by the Dean Postgraduate Studies.
Deficiency courses: As recommended by the student's Advisory Committee and approved by the Dean, Postgraduates Studies.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Bot. 91 Botany I
(For College of Agriculture/Home Science)
Classification of plant kingdom with salient features of each group; cell-structure and its types; cell division, types of cell division. Meristematic and permanent tissues and their types; parts of angiospermic plant; external morphology of root, tap root and adventitious root system, modified tap and adventitious roots; morphology of stem, modifications and functions of stem; structure of leaf, venation, phyllotaxy; modifications and functions of leaf; types of inflorescence, types of fruits; types of ovules; vegetative reproduction-natural and artificial, pollination and fertilization; structure of monocot and dicot seed, seed germination, factors affecting germination and seed dormancy, types of dormancy and factors affecting it. Basic knowledge of crop growth and development, phytohormones: brief account and their use in agriculture.
Practical: Study of different plant parts, description of at least two plant species from each group of plants; preparation of slides of cell and its inclusions, study of different types of roots, their modifications; stem types and their modifications; parts of leaf, leaf types, venation, phyllotaxy, modification of leaf; flower structure, insertion of floral whorls on thalamus, floral diagrams, racemose, cymose and special types of inflorescence; fruit types, structure and germination of monocot and dicot seeds

Bot. 92 Botany II
(For College of Agriculture/Home Science)
Internal structure of dicot and monocot stem, root and leaf; secondary growth; heredity- Mendel's laws of heredity; introduction to taxonomy; Bentham and Hooker's system of classification; study of general characters and economic importance of following families of flowering plants with reference to types mentioned in brackets:- Cruciferae (Brassica, Raphanus), Malvaceae (Gossypium, okra), Rutaceae (Citrus, Murraya), Papilionaceae (Lathyrus, Pism), Rosaceae (Rosa, Prunus), Solanaceae (Petunia, Solanum), Cucurbitaceae (Luffa, Cucurbita), Gramineae (Avena, Triticum); brief account of nutrients; water relations; transpiration, photosynthesis, respiration; growth and factors governing growth; ecosystem-structure and functions, energy flow, nutrient cycling, major biomes-forests; environmental pollution of air, water, soil and noise pollution; ecological succession: types and mechanisms; natural resources -types, use and misuse of natural resources.
Practical: Description of at least two plant species from family in technical terms; examination of prepared anatomical slides of monocot and dicot root, stem and leaf; secondary growth; demonstration of the processes of osmosis, imbibition, conduction of water; role of factors affecting photosynthesis and respiration; deficiency of major and minor elements; study of vegetation in different ecosystems.

Bot. 102 Fundamentals of Botany
(For College of Home Science)
Plant Kingdom, features of each group; morphology, modifications and functions of root, stem, leaf, flower and inflorescence; pollination and fertilization; fruit types and structure of dicot and monocot seed, seed germination; cell structure; DNA, chromosome and genes; cell and tissue types, internal structure of root, stem and leaf; plant taxonomy, systems of classification; characteristics and economic importance of Cruciferae, Malvaceae, Rutaceae, Rosaceae, Leguminosae.
Practical: Salient features of each group of plant kingdom; examination of morphology and modification of root, stem, leaf, flower and types of inflorescence; structure of various types of seeds and fruits; demonstration of cell structure, cell division and tissue types; structure of monocot and dicot root; stem and leaf; permanent slides.
Bot. 103 Basic Botany  1+1  Sem. I & II
(For College of Agriculture)
Plant kingdom, features of each group; morphology of root, stem, leaf, flower and inflorescence; pollination and fertilization; fruit and seed; cell structure, tissue types, internal structure of root, stem and leaf; plant taxonomy, systems of classification; characteristics and economic importance of Cruciferae, Malvaceae, Leguminosae, Cucurbitaceae, Solanaceae and Gramineae.
Practical: Salient features of each group of plant kingdom; examination of morphology and modification of root, stem and leaf, flower and types of inflorescence; structure of various types of seeds and fruits; demonstration of cell structure, cell division and tissue types; structure of monocot and dicot root, stem and leaf; permanent slides.

Bot. 202 Plant Morphology  3+0  Sem.I
Morphology, modifications and functions of root, stem and leaf. Inflorescence types, definition of flower, origin of floral leaves, tendencies in the evolution of the flower, floral anatomy of dicot and monocot flower, morphology of calyx and corolla, structure and morphological nature of stamen, staminodes; morphology of the carpel; vasculature and interpretation of inferior ovary; types of placentation; form, orientation and the nature of ovule; evolutionary relationship of fruit types; detailed morphology of important crop plants: cereals, pulses, fibre crops and oilseeds.

Bot. 203 Systematic Botany  3+0  Sem.II
History of plant taxonomy, modern systems of classification; principles of taxonomy; international rules of nomenclature; botanical gardens and herbaria; General account of floral variation, evolutionary affinities and economic importance of representative families of various orders of the series: Thalamiflorae, Disciflorae, Calciflorae, Inferae, Heteromerae, Curvembryaeae, Multiolatae aquatae, Multiolatae terestris, Microembryaeae, Daphnales, Achlamydosporeae, Unisexuales and Ordines anomali. Evolution of families from the series: Microspermae, Epigynae, Coronarieae, Calycinae, Nudiflorae, Apocarpeae and Glumaceae.

Bot. 204 Plant Histology  2+0  Sem.I
Ultrastructure of cell and its inclusions; cell wall organization and its growth; tissues and tissue systems; shoot and root apical meristems and vascular cambium; anatomy of root, stem, leaf and flower; secondary growth and anomalous secondary growth; distribution of mechanical tissues in plants; galls and tumours; applications of plant anatomy.

Bot. 205 Botany of Economic Plants  2+0  Sem.I
Recent trends and scope of economic botany; Botanical description and commercial products of major categories of food plants (cereals, millets, pulses, nuts, vegetables and fruits), sugar producing plants, oils (essential and edible oils, fatty oils), beverage-, fibres-, latex- (rubber and other latex products), paper and medicinal plants (drugs obtained from various plant parts), biofuels.

Bot. 206 Crop Physiology  2+1  Sem.I & II
Bot. 301 Fundamentals of Plant Physiology 3+0 Sem.II
Plant physiology, its scope in agriculture. Structure and functions of cell organelles; osmosis, imbibition, water absorption, water translocation and transpiration; stomatal mechanisms; source, physiological role and deficiency symptoms of major and minor elements, absorption and translocation of minerals and cell sap; concepts of photosynthesis and respiration, photorespiration, water culture technique; processes involved in growth and development; plant growth regulators: occurrence, biosynthesis, mode of action and commercial applications.

Bot. 302 Basic Experiments in Botany 0+3 Sem.I
Description of plant species from each family in technical terms, study of morphology of different plant parts viz., root, stem and leaf; floral biology of important plants; study of cells and tissues by hand sectioning and maceration; study of anatomical structures in longitudinal and transverse sections of root, stem and leaf. Study of cell, cytoplasm and nucleus; demonstration of processes of osmosis, imbibition, plasmolysis; role of factors affecting photosynthesis and respiration; deficiency symptoms of nutrients in crop plants; processes involved in growth and development.

Bot. 303 Algae, Fungi and Lichens 2+1 Sem.I
Introduction, classification, comparative morphology, reproduction, perennation; economic importance; interrelationships and evolutionary tendencies of algae; structure, reproduction and life cycle of algal species belonging to the different groups viz., Cyanophyta, Chlorophyta, Xanthophyta, Chrysophyta, Euglenophyta, Phaeophyta and Rhodophyta. Nomenclature and classification of fungi belonging to classes Phycymycetes, Ascomycetes, Basidiomycetes and Fungi Imperfecti; general characteristics and life cycles of important genera of fungi and lichens.
Practical: Study of the morphology of different algae and fungi, monographic study of some important algae and fungi.

Bot. 304 Bryophyta 2+1 Sem.II
Introduction, classification, origin and economic importance of bryophytes, their ecology and distribution. Hepaticeae and Anthocerotae: General characters and classification, gametophytes of thalloid and leafy liverworts. Asexual reproduction, sporophytes of liverworts. General account of Anthocerotae and their evolutionary tendencies. Musci: General characters and classification, range of gametophyte structure, asexual and sexual reproduction, sporophyte and alternation of generation; origin and evolution of sporophyte; geographical distribution; cytogenetics and speciation.
Practical: Study of representative types belonging to different groups.

Bot. 305 Pteridophyta 2+1 Sem.II
Introduction; general features; classification; life cycle and alternation of generation; salient features of different groups like Psilophyta, Lycophyta, Sphenophyta and Pterophyta. Study of life histories of following important genera e.g. Selaginella, Psilotum, Lycopodium, Isoetes, Equisetum, Ophioglossum, Dryopteris, Marsilea, Azolla and Salvinia. Origin of Pteridophyta, apogamy and apospory; steler system, telome theory and evolution of sporophyte; heterospory and seed habit, gametophytes of pteriodophytes; fossil pteriodophytes.
Practical: Study of representative types belonging to different groups.

Bot. 306 Gymnosperms 2+1 Sem.II
General description; differences between gymnosperms, higher cryptogams and angiosperms; classification of gymnosperms; detailed study and life cycle of Gingko, Cycas, Biota, Pinus, Ephedra, Gnetum, Welwitschia, Juniperus and Cupressus; process of fossilization.
Practical: Study of morphology, anatomy and reproduction of important genera pertaining to above. Examination of fossil slides.
Bot. 307 Plant Biodiversity and Environment

Concepts of biodiversity, conservation and protection of biodiversity for its suitable utilization; agro-biodiversity and its missions. Diversification of cropping system; introduction of herbal crops in Punjab; vulnerability and extinction of species; endangered species in various ecosystems; use of plant species to check deforestation and desertification; germplasm banks. Response of plants to environmental stresses, greenhouse effect, environmental pollution, pollution of soil and water bodies

Practical: Plant survey methods; excursions and field visits. Effect of environmental factors on plant growth, assimilation rate and biomass partitioning.

Bot.401 Plant Physiology-I (Plant Water Relations and Mineral Nutrition)

Plant cell, membranes, cell organelles; properties of water; osmotic potential, water potential, pressure potential and their relationships; soil water, absorption and translocation of water; plasmolysis, imbibition, stomatal mechanisms, factors affecting water loss, wilting, drought resistance; essential elements: physiological functions and deficiency symptoms of macro and microelements. Mechanism of mineral absorption, factors affecting mineral absorption; microorganisms in relation to nutrient acquisition, nutrient use efficiency.

Practical: Cell structure; preparation of solutions. Demonstrations of processes of diffusion, osmosis, imbibition and plasmolysis; measurements of water potential, membrane permeability, root pressure, guttation, ascent of water, transpiration; deficiency symptoms of nutrients in crop plants; phloem mobility; cation exchange capacity in plant species.

Bot.402 Plant Physiology-II (Plant Metabolism)

Photosynthesis; plant pigments, photosystems, light and dark reactions in C3, C4 and CAM plants; respiration, glycolysis, Pentose Phosphate Pathway, citric acid cycle, electron transport chain; photorespiration and its significance in plant productivity; secondary metabolites and plant defense systems.

Practical: Characterization of pigments; determination of Hill reaction activity; experiments on photosynthesis and respiration.

Bot.403 Plant Physiology-III (Growth, Differentiation and Morphogenesis)

Mechanics of growth and differentiation in plants; factors affecting growth and differentiation; Plant growth regulators (growth promoters, inhibitors and retardants); photoperiodism and vernalization; physiology of seed formation, maturation, dormancy and germination; fruit ripening. Senescence and programmed cell death. Brief account of morphogenesis; polarity, symmetry, regeneration, tissue culture and abnormal growth. Effect of light, water, temperature and growth on morphogenesis.

Practical: Sigmoid growth curve, bioassays of plant growth regulators, their effects on seed germination and plant growth. Experiments on seed dormancy, senescence and fruit ripening.

Undergraduate /M.Sc. Supporting /Minor Courses

Bot.421 Water Relations and Mineral Nutrition

Plant cell, membranes, cell organelles, their structure and function; properties of water; osmotic potential, water potential, pressure potential and their relationship; plasmolysis, imbibition; absorption and translocation of water; stomata, stomatal mechanism, factors affecting water loss, wilting, drought resistance -physiological and molecular basis, essential elements; mineral absorption and translocation. Ion uptake, microorganisms in relation to nutrient acquisition, release and uptake by roots; deficiency symptoms; physiological roles and deficiency diseases; nitrogen metabolism - proteins, nucleic acids and enzymes; yield and mineral nutrition, nutrient use efficiency; molecular aspects of nutrient uptake and transport.

Practical: Cell structure; preparation of solutions, diffusion, osmosis, imbibition, plasmolysis, measurements of \( \psi_w \) and \( \psi_s \); membrane permeability, root pressure, guttation, ascent of water, transpiration experiments; deficiency and toxicity symptoms of nutrients in crop plants; demonstration of ion channels; phloem mobility of various nutrients; estimation of ferrous ions in leaves; plant analysis for N, P and S; cation exchange capacity in plant species; catalase, peroxidase and nitrate reductase activities as indicators of nutrient status of a crop; effect of toxic elements on germination and growth of seedlings.
Bot.422 Photosynthesis, Respiration and Metabolism 2+1 Sem. I&II
Photosynthesis: history, structure of chloroplast, pigments; principles of light absorption by chloroplast, photosystems, photophosphorylation, ATP synthesis; CO₂ fixation and reduction, carbohydrate synthesis, C₃, C₄ and CAM plants; translocation of metabolites; photosynthesis - its mechanism and significance in plant productivity; environmental and agricultural aspects of photosynthesis, photosynthetic efficiency, source-sink relationships and productivity. Respiration: history, mitochondria structure, glycolysis, Krebs cycle, oxidative phosphorylation, cyanide resistant respiration, climacteric and salt induced respiration; energy relationship of aerobic and anaerobic respiration; pentose phosphate pathway, anaerobic respiration; metabolism of lipids and other natural products; fats and oil, phenolic compounds, phytoalexins, lignin, flavonoids, betalains, alkaloids, waxes, cutin and suberin.
Practical: Experiments related to photosynthesis; chlorophyll and other pigment determinations, Hill reaction activity; anatomical characterization of C₃, C₄ and CAM plants. Experiments related to respiration; respiratory quotient; determination of sugar, starch and proteins.

Bot.423 Physiology of Growth and Development 2+1 Sem.I
Concepts of growth, differentiation and pattern formation; growth curves, meristems, growth kinetics, factors affecting growth and general aspects of development, level of differentiation, control of development at genetic level. Hormones and growth regulators - auxins, gibberellins, cytokinins, ethylene, ABA, other inhibitors, retardants, polyamines, alphatic alcohols, brassins, hormonal regulation of growth and development, plant movements; photoperiodism, phytochrome, flowering hormones, vernalization, abscission, ageing, senescence; physiology of seed and fruit development; seed germination; seed and bud dormancy. Plant physiology and agriculture

Bot. 424 Plant Anatomy 2+1 Sem.II
Cell structure, cell wall, meristems; tissues and tissue systems; primary and secondary xylem and phloem; vascular cambium; periderm; internal structure of monocot and dicot root, stem, leaf, fruit and seed; secondary growth - normal and anomalous; storage region in root and tuber crops; origin of lateral and adventitious roots; healing of wounds, grafting and abscission; ecological anatomy; leaf anatomy of C₃, C₄ and CAM plants.
Practical: Cell structure, cell wall - prepared slides and slide preparation; simple and double staining to study different types of simple and permanent tissues, leaf, root, stem, fruit and seed; study of normal and anomalous secondary growth; anatomy of representative storage roots and tuberous crops

Bot.425 Taxonomy of Angiosperms 2+1 Sem.I
History of plant taxonomy; modern systems of classification; principles of taxonomy, modern trends in plant classification; chemotaxonomy; numerical taxonomy; international rules of nomenclature; relationships of experimental and orthodox taxonomy; taxonomy in relation to anatomy, cytology, palynology, embryology and chemistry. General account of floral variations, evolutionary affinity and economic importance of families-Ranunculaceae, Papaveraceae, Brassicaceae, Malvaceae, Rutaceae, Caesalpinaceae, Mimosaceae, Rosaceae, Scrophulariaceae, Chenopodiaceae, Euphorbiaceae, Solanaceae, Cucurbitaceae, Papilionaceae, Liliaceae, Amaryllidaceae, Cyperaceae and Poaceae.
Practical: Technical terms and symbols used in description of plants and descriptive procedure for taxonomic studies, detailed study of taxonomic features of at least one plant belonging to above families. Demonstration of various herbarium techniques and collection of local flora.

Bot.426 Morphology of Crop Plants 2+1 Sem.II
General morphology and origin of important crop plants, i.e. wheat, rice, maize, cotton, groundnut, mustard, sunflower, sugarcane, potato and pulses; vegetative and reproductive growth of these plants with emphasis on their floral biology, mode of reproduction, seed formation and economic importance.
Practical: Study of morphology and floral biology of the above crop plants.
Postgraduate Courses

**Bot.501 Cellular and Developmental Plant Physiology**  
3+1  
Sem.I  
Structure and physiological functions of plant cell and cell inclusions; mechanism of water uptake, aquaporins, transpiration, stomata structure, stomatal movement, antitranspirants; mineral elements, their role in plant metabolism; transport proteins; mechanism of uptake and translocation of minerals in plants; nutrient deficiency and toxicity; N, P and S metabolism; photosynthesis, its importance in bioproductivity, photochemical reactions, CO2 fixation in C3, C4 and CAM plants, photosynthesis, carbohydrate synthesis, translocation of photosynthates and source-sink relationship; mitochondrial respiration, ATP synthesis, cyanide resistant respiration; plant growth regulators, their biosynthesis, mechanism of action and their role in agriculture; regulation of growth and development; physiology and biochemistry of seed dormancy and seed germination; photomorphogenesis, photoreceptors, photoperiodism; vernalization; senescence and abscission; fruit growth and ripening; biotic and abiotic stresses (drought, flooding, salinity, high and low temperature, anoxic and radiation) affecting plant metabolism and growth; signal transduction in plants cells.

Practical: Measurement of plant water status; determination of water potential and its components; physiological role and deficiency symptoms of macro- and micro-elements; characterization of plastids; pigments; determination of Hill reaction activity; experiments demonstrating involvement of ion channels in ion uptake and calcium in signal transduction; sigmoid growth at organ and whole plant level; bioassays to demonstrate the occurrence of plant hormones; experiments demonstrating physiological effects of PGRs; experiments on tropism, seed dormancy, germination, senescence and fruit ripening.

**Bot.502 Plant Anatomy and Embryology**  
2+1  
Sem.I  
Modular, tissue and cellular organization of plant body; differentiation, totipotency and morphogenesis; ultrastructure of plant cell, development of cell wall; tissues - their ontogeny in relation to functional specialization, transfer cells; meristems; structure and development of stem, root and leaf, stomata and secretory tissues; origin of cambium, unusual secondary growth, structure of flower, mega and microsporogenesis, pollen pistil interactions, fertilization, embryo development, polyembryony, parthenogenesis, parthenocarpy, abscission, healing of wounds and union of grafts; application of applied plant anatomy and embryology in crop improvement.

Practical: Study of structure of parenchyma, collenchyma, sclerenchyma, xylem and phloem, transfer cells, laticifers, stomata, epidermal glands; structure and organization of shoot apex and root apex; origin of procambium and cambium; secondary growth and anomalous secondary growth; variations in organization in stem, root and leaf.

**Bot.503 Taxonomy and Biosystematics**  
2+1  
Sem.I  
Principles of taxonomy as applied to systematics and classification of plant kingdom; plasticity of phenotype, phenotypic variability; plant geography; sympatric and allopatric taxa; primary and secondary centres of origin; adaptive radiations; abrupt and general speciation mechanisms; speciation in vegetatively reproducing plants; ecological properties of a species; pattern of ecotypic differentiation; structural, biochemical and molecular systematics; modern systems of classification; numerical taxonomy; herbaria-field and herbarium techniques; botanical gardens; floristics and botanical survey of India; taxonomic structure; floristics; diagnostic features and economic importance of important families. origin and evolution of economically important plants; plants and civilization; centres of origin and gene diversity; botany, utilization, cultivation and improvement of plants of food, drug, fibre and industrial use; unexploited plants of potential economic value; plants as a source of renewable energy.

Practical: Description of families (Magnoliaceae; Papaveraceae; Brassicaceae; Malvaceae; Rutaceae; Meliaceae; Fabaceae; Rosaceae; Myrtaceae; Cucurbitaceae; Apiaceae; Rubiaceae; Asteraceae (Compositae); Solanaceae; Scrophulariaceae; Lamiaceae; Chenopodiaceae; Euphorbiaceae; Orchidaceae; Musaceae; Zingiberaceae; Amaryllidaceae, Liliaceae, Arecaceae; Araceae; Cyperaceae and Poaceae) collection of plants and preparation of herbarium; identification of economic plants and plant products. Excursions and field visits.
Bot.504 Plant Ecology  2+1  Sem.II
Concepts of ecology, autecology, syneceology; concepts and dynamics of ecosystems, types of ecosystem; components of food chains and energy flow; succession, management and ecological pyramids; community structure and dynamics, biogeochemical cycling, climate and vegetation of India; ecological adaptations; environment pollution, environmental monitoring, environment impact assessment, sustainable development, remote sensing of ecological research, economic importance of microbes, plants and animals.
Practical: Experiments on community structure and dynamics, floristic composition; succession. Experiments on pollution, remote sensing of agricultural and ecological systems.

Bot.505 Plant Biotechnology  2+0  Sem.II
Principles and methods of genetic engineering of plants with particular reference to photosynthesis, nitrogen fixation and seed proteins; rapid plant propagation by tissue culture; cell lines; cell clones; in vitro approaches to the genetic manipulation of plants; blotting technique; polymerase chain reaction, protoplast fusion, somatic hybridization; hybrid and cybrid production; haploid plant production; somatic embryogenesis and artificial seeds; hybridoma technology; allopheny; pre-fertilization treatments of pollen for directed genetic change; in vitro manipulation of ovule tissues; germplasm maintenance and storage; growth regulators in relation to plant productivity; Prospects of Plant Biotechnology in crop improvement; molecular farming; molecular probes; omics technologies and their applications.

Bot.506 Histochemistry and Plant Ultrastructure  1+1  Sem.II
Histochemistry and cytochemistry - principles; botanical microtechniques; stains and staining procedures; microscopy - principles of light and electron microscopes; microscopic measurements; general structure, importance and histochemical procedures for localization of reserve substances like polysaccharides, lipids, proteins, nucleic acids and some important enzymes in plant tissues; histochemical analysis of some plant processes like abscission, reproductive development, stomatal movement, etc. Ultrastructure of plant cell membrane, cell wall, nucleus and some organelles; endoplasmic reticulum; lysosomes; ultrastructure of meristematic cells; phloem, cambium, guard cells, embryosac, etc.; role of histochemistry in collation of structure with function.
Practical: Processing of plant material for microtome sectioning and preparation of slides; histochemical localization of reserve substances and enzymes in plant cells/tissues in hand sections and microtome sections.

Bot.507 Plant Biodiversity and Environmental Conservation  1+1  Sem.I
Agrobiodiversity, its missions and concerns; conservation and protection of biodiversity for its sustainable utilization; multipurpose tree management; diversification of cropping system; introduction of Herbal crops in Punjab; vulnerability and extinction of species; distribution and ecology of endangered species in various ecosystems; use of plant species to check deforestation, desertification and pollution of water bodies; germplasm banks.
Practical: Plant survey methods; plant diversity at PAU campus, diversity in medicinal herbs, shrubs and trees, diversity in ornamental and field visits.

Bot.508 Plant Morphogenesis  2+1  Sem.II
Organization of structure and function at molecular, cellular, tissue, organ and whole plant level, cellular polarity and regulation of cell and tissue dimension, pattern formation and cellular differentiation, organization of shoot apical meristem, leaf development and differentiation, root apical meristem, root hair, stomata and trichome development, floral development and differentiation, seed and fruit development; Organogenesis of root, stem, leaf, flower, fruit, and seed. Totipotency; apical dominance and phase change; biochemical, physiological and hormonal plant mutants, hormones, agonists; elements of cellular transduction in relation to differentiation in plants; programmed cell death; photomorphogenesis; in vitro regulation of differentiation and development in higher plants.
Practical: Effect of light, temperature and plant growth regulators on cellular differentiation and organogenesis.
Bot.509 Environmental and Stress Physiology  
Principles of environmental physiology; Response of plants to abiotic stresses and its effect on productivity; interactions between biotic and abiotic stresses; plant responses to freezing, chilling and high temperature; role of membrane lipids, HSPs; drought, osmoprotectants, water use efficiency as drought resistant trait; soil salinity, species variation to salt tolerance, flooding and anaerobiosis; radiation stress; air and water pollutants; green house effects at cellular and whole plant levels; heavy metal stress; physiological and molecular mechanisms to combat stresses by plants; stress and hormones, ABA as signaling molecule; cytokinin as a negative signal, oxidative stress and role of reactive oxygen species (ROS) scavenging system (SOD and Catalase etc); basic principles of crop improvement programmes under stress, mineral cycling and energy transfer in biotic and abiotic components; mutualism, competition, allelopathy; crop-land ecosystem.
Practical: Laboratory and field experiments on the effect of abiotic stresses, e.g. water high temperature salinity, heavy metal toxicity, pollutants, radiation; estimation of free fatty acids level, membrane integrity; and proline content in relation to abiotic stresses, estimation of nitrates in irrigation waters, allelopathy and composition in agri-ecosystems.

Bot.510 Growth Regulators  
Plant growth regulators; definition, classification, biosynthesis, transport, metabolism, physiological role and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, polyamines, phenols, salicylic acid, triacontanol, brassinolides, jasmonic acid; concept of death hormone - nitric oxide, etc.; inhibitors, retardants, synthetic growth regulators and their practical utility in agriculture and horticulture; concept of second messengers; hormone receptors; pathways of signal transduction associated with plant hormones; hormone mutants and transgenic plants in relation to hormone action; hormonal regulation of gene expression; application of hormones in rooting of cuttings, apical dominance, flowering and fruit development.

Bot.601 Advances in Botany  
Plant development- new perspectives, molecular and hormonal coordination of plant development; recent development in control of phyllotaxic patterns of plants; programmed cell death; secretary tissues in plants; applications of plant anatomy in structure -function correlations; impact of environmental pollution on plant structure; plant defense mechanism in disease resistance; epicuticular waxes and role in stress tolerance; phytoremediation; phytoextraction of toxic metals; molecular mechanisms of roots nodule development; nitrogen fixation by legumes in tropical and sub- tropical crops; biofertilizers; long-distance signaling to control root nodule number and role of flavonoids; recent development in plant tropism; providing the power of movement to sessile organisms; membrane traffic within the golgi apparatus and intra-golgi cargo transport; COPI vesicles as long distance carriers; alkaloid biosynthesis - histochemistry and metabolism; crop simulation models in agriculture; mechanism of carnivorous nutrition in higher plants; retrograde signaling in plants: from plastid to nucleus; weed biology, ecology and physiology, weed and crop competition, allelochemicals their nature and impact, weed- seed physiology; application of nanotechnology in agriculture.

Bot.602 Advances in Plant Physiology  
Recent advances in plant physiology and molecular biology; plant hormones and their role in integration of growth and development; hormones receptors, transduction process, effector molecules and gene expression; hormone action mutants, elements of signaling pathways and mechanism of signal transduction; two components sensing system; cross talk in the signaling of different hormones; calcium a silver bullet in signaling and regulation of metabolism; abiotic stress signaling, case studies with different stresses; transgenic approaches in improving physiological processes; importance of mutants in unraveling physiological processes; molecular aspects of nutrient uptake and transport, nutrient sensing and signaling; ABC- transporters; conventional and biotechnological approaches to improve yield potential and quality of
crop plants. New emerging technologies and their scope in crop improvement; scope of plant physiology in the era of second green revolution

Bot.603 Advances in Reproductive Biology 2+0 Sem.I
Introduction; approaches to study mechanisms of reproductive development; cell determination and cell interactions in reproductive meristems; floral induction, physiological signals and multi-factorial system of control of floral metamorphosis; ABC model for floral organ specification; development of egg cell and its role in fertilization; suspensor and its importance in embryo development; endosperm origin, development and functions; molecular basis of microsporogenesis; Self-incompatibility mechanisms; mutations affecting gametophyte development; regulation of pollen viability, germination and tube growth; pollen-pistil interactions, new concepts of recognition in plants; seed development, deposition of storage reserves, embryo maturation and desiccation; cytoplasmic male sterility and hybrid seed production; fruit development, fruit ripening and role of fruit wall in seed development; physiological and molecular aspects of fruit ripening and senescence, role of plant hormones in reproductive development; scope for genetic modification of post harvest life of flowers and fruits; mechanism of seed and fruit abortion and means to overcome it; impact of environmental factors on reproductive development in relation to productivity.

Bot.604 Advances in Morphogenesis 2+0 Sem. I
Introduction, phenology of morphogenesis; cell cycle - historical perspectives, mechanism and regulation; cytokinesis in pattern formation- meristems in plant development; initiation and regulation of development pathways; hormonal regulation of developmental processes; apical dominance; abnormal plant growth- hormonal and elemental control; photomorphogenesis- photoreceptors for various light regions; phytochrome and light control of plant development; blue-light mediated responses and morphogenesis; photoregulated gene expression in plants; phytochrome transgenes - their biotechnological applications; plasmodesmata-dynamics, domains and patterning and intracellular communication through plasmodesmata; morphogenesis and molecular genetic analysis of trichome development; asymmetric cell division in plants; plasma membrane interaction with the cytoskeleton and cell wall; morphogenetic and molecular aspects of stomatal development; orientation of spacing and patterning of stomata; genetic architecture of leaf morphogenesis, model for leaf morphogenesis.

Bot. 605 Molecular Approaches for Improving Physiological Traits in Crop Plants 3+0 Sem. I
Introduction to physiological traits relevant to growth, development and productivity, nutrient acquisition; abiotic and biotic stress tolerance; importance of mutants in unraveling important physiological processes; importance of molecular plant breeding in crop improvement; basic aspects of genomics, proteomics, and metabolomics and their potential applications; genetic markers and their comparison with conventional methods; PCR: rationale, techniques and applications; DNA-based marker systems and their applications; linkage maps and mapping populations; strategies for quantitative traits loci (QTL) introgression and marker assisted selection (MAS) for crop improvement; recombinant DNA technology: gene transfer methods; selection of transformants and their analysis using physiological / biochemical and molecular approaches; applications of transgenics; molecular farming; issue related to biosafety and registration of genetically modified (GM) crops.

Bot. 606 Plant Responses to Climatic Change and Abiotic Stresses 2+0 Sem. II
Climate change and its implications; greenhouse gases and their influence on global warming and climate change; long and short-term projections of climate change: effects on natural vegetations and ecosystems, crop-pest interaction, area shift, food production and supply. plant responses to freezing, chilling, heat, drought stress; role of membrane lipids in stress tolerance; function of HSP's; osmoprotectants, water use efficiency as drought resistant trait; mechanism for tolerance to salinity, heavy metals, flooding, radiation and oxidative stress; ROS and scavenging system; basic principles of crop improvement programme under stress. Approaches to mitigate climate change through studies on plant responses; direct and indirect effects of environmental stresses on plant processes: phenology, net carbon assimilation, water relations, grain development and quality, nutrient acquisition and yield; conventional and biotechnological approaches to improve the crop adaptation to climate change; relevance of “Genome wide mutants” to
identify genes/processes for improved adaptation to changing environments; International conventions and
global initiatives on carbon sequestration, carbon trading.

**Bot. 607 Seed Physiology**

2+0  Sem. I

Importance and structure of seeds; physiology of seed and fruit development; environmental effects on
seed development: physiological and molecular aspects; seed development patterns and source of
assimilates; control processes in mobilization of assimilates in developing seeds of monocots and
dicots; chemical composition, biosynthesis, storage of carbohydrates, proteins and fats in seeds; gene
imprints and seed and fruit abortion and means to overcome it; seed respiration; seed ageing; chemistry
of oxidation of starch, protein and fats, utilization of breakdown products by embryonic axis; inception of
germination: hormonal and molecular regulation of seed germination events; seed maturation and
desiccation damage: role of LEA proteins; precocious seed germination; seed viability: physiological and
 genetic aspects to prolong viability; seed vigour: concept, importance, measurement; invigoration -
methods and physiological basis: orthodox and recalcitrant seeds; types of seed dormancy, structural and
chemical basis of seed coat impermeability and hard seededness; means to overcome dormancy.

**Bot. 591 Seminar**  Sem. I & II

**Bot. 600 Master's Research**

**Bot. 700 Ph. D. Research**
BUSINESS STUDIES

PROGRAMMES

M.B.A.

Ph.D.

M.B.A. (Agribusiness)

COURSE REQUIREMENT

M.B.A.

Field of Specialization

Agribusiness Management, e-business.

Required courses

Mgt. 501, Mgt. 502, Mgt. 503, Mgt. 504, Mgt. 505, Mgt. 506, Mgt. 507, Mgt. 508, Mgt. 509, Mgt. 510, Mgt. 511, Mgt. 512, Mgt. 513.

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

Economics, Sociology, Extension Education, Statistics, Computer Science or any other as approved by the Dean Postgraduate Studies.

Deficiency courses

As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph.D.

Field of Specialization

Financial Management, Marketing Management

Required courses

Mgt. 601, Mgt. 602, Mgt. 695.

Supporting courses

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

Minor Fields

Economics, Statistics, Electrical Engineering (Systems and Control) or any other as approved by the Dean Postgraduate Studies.

Deficiency courses

As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

M.B.A. (Agribusiness)

Field of Specialization

Agribusiness Management

Required courses

ABM 501, ABM 502, ABM 503, ABM 504, ABM 505, ABM 506, ABM 507, ABM 508, ABM 509, ABM 510, ABM 511, ABM 512, ABM 513.

Supporting courses

Stat 421, PGS 501 Eng 503 and other courses from subject matter fields (other than Minor) relating to area of special interest and research problem.

Minor Fields

Economics, Sociology, Extension Education, Statistics, Computer Science or any other as approved by the Dean Postgraduate Studies.

Deficiency courses

As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

**Mgt. 51 Introduction to Marketing Management** 2+0  Sem I
Introduction to marketing management. Marketing concepts and managerial functions of marketing. Understanding market and marketing management, segmentation targeting and positioning. Marketing mix-product, price, place and promotion. Developing marketing strategies for services. Marketing practices of selected Indian companies.

**Mgt. 52 Production and Personnel Management** 2+0  Sem II

**Mgt. 53 Accounting and Financial Management** 2+0  Sem II

**Mgt. 54 Entrepreneurial Development** 2+0  Sem II
Introduction to the concept of entrepreneurship, classification and types of entrepreneurs, women entrepreneurs, institution in aid of entrepreneurs. Steps for starting a small industry, site selection, selection of type of organization. Brief introduction to various functional area of enterprise management viz. finance and accounts, marketing production/operation, personnel, MIS and R&D. Problems of entrepreneurs specially problems faced by women entrepreneurs, key success factors in small scale industry.

**Mgt. 301 Fundamentals of Entrepreneurship** 2+0  Sem II

**Mgt. 302 Accounting and Inventory Management** 2+0  Sem I

**Mgt. 303 Fundamentals of Agri-business Management and Entrepreneurship Development** 2+0  Sem II
Agri-business- meaning, definition, features and structure of agri-business (input, farm and processing

Mgt. 401 Fundamentals of Agribusiness Management 2+0 Sem II

Mgt. 421 Introduction to Management and Marketing 2+0 Sem II
Nature and process of management, forms of business organization, nature and process of planning. Organizing - nature, process, authority relationship, delegation of authority, centralization and decentralization, directing, communication, motivation, leadership. Controlling - nature and concept, functional areas of management, marketing management - nature and concept, marketing decisions, marketing strategy, market segmentation and consumer purchase behavior.

Mgt. 422 Agribusiness Management and Trade 3+0 Sem I

Mgt. 423 Introduction to Entrepreneurship and Marketing 2+1 Sem I

Mgt. 424 Fundamentals of Marketing Management 2+0 Sem. I
Marketing management: meaning, significance and importance of markets and marketing. Marketing environment, marketing research, marketing mix. Segmenting, targeting and positioning. Buyer behaviour: motives and factors influencing the various stages of buying process. Product decisions: product life cycle,
new product development, product planning, product mix, product line and branding decisions, packaging and labeling. Pricing decisions: methods of pricing, price adaptations. Introduction to marketing channels and promotion mix. Introduction to sales management.

**Mgt. 433 Financial and Project Management**  
3+1  Sem. I  

**Mgt. 434 Retailing and Supply Chain Management**  
3+0  Sem. I  

**Postgraduate Courses**

**Mgt. 501/ABM 501 Principles of Management and Organizational Behaviour**  
3+0  Sem.I  

**Mgt. 502/ABM 502 Business Environment**  
3+0  Sem.II  

**Mgt. 503/ABM 503/Econ. 501 Managerial Economics/ Micro Economics**  
3+0  Sem.I  

Mgt. 504/ABM 504 Managerial Accounting and Control 2+1 Sem.I
Practical: Numerical problems, case studies: analysis and discussion.

Mgt. 505/ABM 505 Marketing Management 3+0 Sem I

Mgt. 506/ABM 506 Human Resource Management 3+0 Sem. II

Mgt. 507/ABM 507 Financial Management 3+0 Sem II
Introduction to financial management: meaning, functions, nature, objectives. Interface of financial management with other functional areas of a business. Financial statements and analysis: proforma balance sheet and income statements, ratio, time series, common size and Du-Pont analysis. Capital structure:

Mgt. 508/ ABM 508 Production and Operations Management 3+0 Sem II
Nature and scope of production and operations management- its relationship with other systems in the organization. Production functions, work and job design, facilities planning, product and process selection. Product design and development- importance of product design, characteristics of good design, technical process of new product development, design for manufacture, concurrent engineering. Facilities location- importance, location analysis techniques, facilities layout and materials handling. Capacity planning- measuring capacity, process of capacity planning, methods for altering capacity in long term and short term. Production planning and control for different types of manufacturing systems, planning and control of projects, work study, method study, work measurement, work sampling, maintenance management, value engineering, quality assurance and quality circles. Total quality management, purchase system and purchase principles, inventory management, stores management, standardization, codification, quality control, certification systems and waste management.

Mgt. 509/ABM 509 Research Methodology in Business Management 2+1 Sem II

Mgt. 510/ABM 510 Strategic Management 3+0 Sem II

Mgt. 511/ ABM 511/IT 530 Management Information System 2+1 Sem I
Concepts, needs and scope of MIS in business organization. Understanding business as a social system

Mgt. 512/ABM 512/Econ 508/Stat 527 Quantitative and Optimization 2+1 Sem II

Techniques for Economics and Management
Role of quantitative methods in decision making, probability and decision making under risk and uncertainty, the value of additional information, Bayes theorem, probability models and decision making. Sample survey methods, measurement and forecasting, index numbers, time series analysis, optimization models, linear programming: formulation and simplex method, primal and dual, sensitivity analysis, transportation models and assignment models, dynamic programming, network analysis, PERT and CPM. Game theory: concept, two person constant sums, zero sum games, saddle point, solution to mixed strategies, Markov chain analysis, Queueing models - waiting line problem, characteristics of waiting lines, single-channel model, multiple-channel model, constant-service time model, finite population model, sequencing and replacement models. Simulation and Monte Carlo methods.

Practical: Graphical and algebraic formulation of linear programming models. Solving of maximization and minimization problems by simplex method. Formulation of simplex method by typical farm situations. Solution of other numerical problems, case studies, analysis and discussion.

Mgt. 513/ABM 513 Project Management and Entrepreneurship Development 2+1 Sem II

Concept and nature of projects, characteristics and types of projects, generation, identification and screening of project ideas, project life cycle. Formulation of projects: market and demand, technical and financial feasibility, preparation of feasibility report, methods for evaluation and ranking of projects, risk analysis for projects, impact of inflation on projects, public and private projects, financing of projects, sources of finance and structure of financial institutions related to project financing, venture capital, central and state incentives, contract management for projects. Implementation of project: network methods, project scheduling and resource allocation, project control and information system, monitoring and feedback, operational problems in implementation of projects. Concept and theories of entrepreneurship, significance of entrepreneurship in economic development, types of entrepreneurs, women and rural entrepreneurs, qualities of an entrepreneur, entrepreneurship development programmes and role of various institutions in developing entrepreneurship, lifecycle of new business, environmental factors affecting success of a new business, reasons for the failure and visible problems for business, developing effective business plans, procedural steps for setting up an industry.

Practical: Exercises in project formulation, numericals related to project evaluation, risk analysis and case studies.

Mgt. 514 Brand and Advertising Management 2+1 Sem I

and objectives. Message strategy: copy writing, copy testing strategy. Media strategy: media budget, media vehicle decisions.

Practical: Case studies, analysis and discussions.

**Mgt. 515 International Marketing**

3+0  Sem II


**Mgt. 516 Sales Management and Consumer Behavior**

2+1  Sem I


Practical: Case studies, analysis and discussions.

**Mgt. 517 Retail Management**

3+0  Sem I


**Mgt. 518 Managing Rural Markets**

2+1  Sem II

Nature and magnitude of rural markets in India. Socio-cultural factors in rural marketing. Rural sales organization, special requirements for marketing in the rural areas with regard to product planning, communication channels, media and messages, marketing of agricultural inputs, distribution channels and systems, demand creation and market development, marketing of agri-inputs such as seeds, fertilizers, pesticides and farm machinery. Marketing of agricultural outputs. Determination of agricultural output and prices with special reference ACP Commission, systems of procurement- role of FCI and other procurement agencies, grading farm products, warehousing and cooperative marketing.

Practical: Case studies

**Mgt. 519 Physical Logistics**

2+1  Sem. II

Concept and significance of physicals logistic and distribution system; marketing and physical distribution process; elements of physical distribution system, transportation and its relation to plant location, warehousing and inventory; modes of transportation optimum relationship between size and frequency of shipments; transportation model; cost analysis and logistic system design; organization and management of physical distribution and logistic systems

Practical: Exercise, case studies, analysis and discussions

**Mgt. 520 Management of Financial Institutions**

2+1  Sem.I

Concept of capital market-role of specialized financial institutions and commercial banks. Consideration of bank functions, objectives, policies, organizations; management of primary and secondary reserves- cash management and portfolio management; management of loans and advances, credit analysis and
control. Tandon Committee and Chore Committee recommendations for Bank Financing. Management of funds and income, deposit and deposit mobilization, profitability analysis of commercial banks, management control and appraisal-transfer price mechanism, performance budgeting, evaluation of bank performance. Genesis of specialized financial institutions- IDBI, IFCI, ICICI, UTI, NABARD, LIC, SFCs and SIDBI - a brief overview of their objectives, functions and role, adequacy of capital and strategy of growth.

Practical: Case studies, analysis and discussions.

Mgt. 521 Management Control Systems 2+1 Sem.I
Functioning and structure- nature, functioning and objectives of control systems-strategic planning, management control and operational control, organizational relationships in management control, behavioral implications, motivation and goal congruence, management control structure-decentralization, responsibility centers-expense, profit and investment centers. Control process, budgeting and budgetary control, types of budgets and their preparation. Installation and evaluation of comprehensive budgeting control system. Standard costing and budgetary control. Analysis and reporting performance. Special management control situations-service organization, non-profit organizations and control of projects.

Practical: Case studies and Analysis.

Mgt. 522 Management of Financial Services 3+0 Sem I

Mgt. 523 Investment Management 2+1 Sem.II
Investment objectives and constraints, types of investors. Investment analysis and stock exchanges in India. Market efficiency, modern portfolio theory, types of investment products. Security analysis-quantitative and qualitative variables, fundamental and technical analysis techniques, fixed income securities, portfolio management and performance measurement, derivative products - futures and options.

Practical: Numerical exercises and case studies, analysis and discussions.

Mgt. 524 International Financial Management 3+0 Sem II

Mgt. 525 Tax Planning 2+1 Sem II
Concepts and significance of tax planning, tax evasion and avoidance. Tax environment, implications and their impact on financial decision making and enterprise behavior. Fiscal policy and impact of central and state budgets, taxes under the jurisdiction of Union and state governments classification of taxes. Salient features and main legal provisions of income tax and other acts relating to incentives and concessions. Tax planning for individuals and corporate sector.

Practical: Numerical exercises and case studies.
Mgt. 526 Production Planning and Control 2+1 Sem I
Nature and objectives of production planning and control, variables subject to control. Production control for continuous, intermittent and project systems. Learning curve effects, production forecasting and production inventories. Aggregate planning guidelines, graphic and charting methods, mathematical planning models. Scheduling philosophy, scheduling methodology and control techniques. Development of means to reporting production and comparison of schedule with actual performance development of standards.
Practical: Exercises in the use of quantitative techniques and analysis and discussion of case studies.

Mgt. 527/ Econ. 503/ Stat 511 Econometrics 2+1 Sem. I
Practical: Practicals on single equation two variable model specification and estimation, hypothesis testing, transformations of functional forms and OLS application. Estimation of multiple regression models - hypothesis testing, testing and correcting specification errors, testing and managing multicollinearity, heteroscedasticity, autocorrelation. Estimation of regressions with dummy variables, estimation of regression with limited dependent variable. Identification of equations in simultaneous equation systems.

Mgt. 528 Cost Control and Value Analysis 2+1 Sem I
Practical: Case studies in value engineering.

Mgt. 529 Work Study 2+1 Sem II
Work measurement, work simplification or reduction of human effort through simplifying, combing, eliminating or changing processes. Study of process charts, study of symbols including therbligs. Meaning of effecting work simplification through time and motion study. Development of standard method's and standard times for all operations.
Practical: Exercises, case studies, analysis and discussions.

Mgt. 530 Operations Management 3+0 Sem II
Planning and organization of operations, operations management concepts, material and equipment inputs, human resource inputs and capital inputs. Use of advanced computer techniques. Directions and control of operations, product and process analysis, forecasting various control techniques including inventory, quality, maintenance and cost control. Operating environment.

Mgt. 531 Purchasing and Materials Management 3+0 Sem II
Fundamentals of purchasing and materials management, determinants of right materials, quality specifications and standardization, reliability and inspection, price, service and delivery, sources of supply, make or buy decisions, inventory control systems, value analysis/engineering, traffic, stores and record keeping, management of procurement and materials activities, institutional and government purchasing.

Mgt. 532 Personnel Management Practices 2+1 Sem.I
Role of personnel manager in organisation, status and background and personnel managers, personnel policies framework, formulation and execution of policies relating to major personnel functions, current
development and role of social and demographic factors in personnel functions. Industrialization - its
growth implications and problems. Role of industrial psychology in job analysis and personnel testing.
Performance appraisal, training and development, job and work situation and job satisfaction. Current
developments and personnel practices on effective functioning of an organisation.

Practical: case studies, analysis and discussions.

**Mgt. 533 Human Resource Development**  
3+0  Sem.I

- Concept, significance and mechanisms of HRD. Line managers and HRD, Developmental supervision,
Management development and HRD. Motivational aspects of HRD. Career planning and development,
performance management and internal mobility. Executive training- satisfaction of training needs of
executives, supervisions and managers, training programmes, methods and techniques evaluations of
training programme and progress, training budget. Management training and development in India.
Organizational culture and Quality of Work Life. Organization development (OD) and HRD-components,
process and technology of OD, team building.

**Mgt. 534 Industrial Relations in India**  
2+1  Sem.I

- Industrial relations, role of government in IR and industrial conflicts, code of discipline, standing orders,
grievance handling, mediation, conciliation, adjudication, arbitration, trade unions and industrial
relations, collective bargaining, industrial democracy. Labour welfare-concept, nature and types of welfare
plans, welfare administration. Welfare legislation -social security administration. Industrial relations in
western countries. Industrial relations in public and private sectors in India. Problems of industrial relations
at major industrial towns.

Practical: Case studies, analysis and discussions.

**Mgt. 535 Business Ethics and Indian Management**  
3+0  Sem.II

- Societal concept and social responsibility of business: spectrum of social issues-conservation of natural
resources, pollution control and other environmental issues. Fair business practices, human resources,
consumer and community involvement. Business ethics and unethical behaviour of managers. Ethical
code and legal requirements in different areas. Ethical pressure points, pressure from superiors, comparative
conceptual disparity and ambiguous situations. Ethical climate of organisation, policies and guidelines of
ethics, educational influence, code of conduct, ethical advisor, value systems of Indian managers.

**Mgt. 536 Industrial and Labour Laws**  
2+1  Sem.II

- Concept of labour welfare and role of industrial and labour legislation, safety and welfare legislation,
Factories Act, Workmen's Compensation Act, Minimum Wages Act, Employees State Insurance Act,
Employees Provident Fund Act, Employees Family Pension Scheme, Maternity Benefit Act, Payment of
Bonus Act, Trade Union Act. Administration and labour laws.

Practical: Case studies, analysis and discussion.

**Mgt. 537 Farm Business Management**  
3+0  Sem.I

- Nature, scope and functions of farm business management, working out existing and alternative farm
plans, farm labour, farm capital and its problems, farm machinery and its utilization, decision making
process in farm management, application of quantitative techniques in agricultural production,
marketing of agricultural output, purchasing the agricultural inputs, management of other special farm
projects like poultry, dairy, fishery, bee-keeping and piggery, farm forecasting and other special managerial
problems of farms.

**Mgt. 538 Management of Cooperatives**  
3+0  Sem.I

- Nature of cooperative principles, management principles and their applications to cooperative organizations,
structure and functions of various types of cooperatives, managerial problems of cooperatives,
consumer stores, role of government, financing of cooperatives, staffing and training, efficiency criteria,
public accountability, price, output and profit policies of cooperatives. Special problems of cooperatives in
agricultural and industrial sectors, management practices of successful cooperatives in India.

**Mgt. 539 Agricultural Marketing**  
3+0  Sem.I

- Advanced study of organization and function of agricultural marketing in India. Market structure and
performance, determination of price and marketing margins, technological evolution and integration in agricultural processing, distribution; warehousing and cooperative marketing; methods of grading of farm product-market grades, unique features of commodity marketing in India. Market legislation- a historical and critical review; magnitude and dimensions of marketed and marketable surplus of agricultural commodities; efficiency of marketing, storage, transportation and financial management in agricultural marketing, perishability, seasonability and processing of different agricultural products, pricing of processed products and demand creation.

Mgt. 540 Rural Finance 3+0 Sem.II
Functions, structure and working of rural financial market in India, role of rural financing institutions like NABARD, RRBs, credit policies of various financing institutions, agricultural credit policy since independence, mobilizing rural savings, rural deposits mobilization by cooperatives, innovative financing, intensive financing, village adoption.

Mgt. 541 Management of Strategic Organizations 3+0 Sem.II
Concept and significance of strategic organizations, public sector enterprises, Sunrise industries, research and training institutions, development oriented voluntary organizations, extension and promotional agencies, form, objectives, special features, internal structure, staffing and training, efficiency criteria, public accountability, motivation, control and leadership in strategic organizations with special reference to public sector enterprises and developmental agencies.

Mgt. 542 Management of Agro-Industrial Projects 2+1 Sem.II
Nature of agro-industrial projects. Formulation of agro-industrial projects - economic, technical and financial feasibility, generation of alternative project ideas and preliminary screening; methods for evaluation and ranking of projects, preparation of feasibility report, financing of agro-industrial projects, sources of finance and structure of financial institutions, central and state incentives, implementation of project, organization viability, management control and information system, monitoring and feedback, operational problems in implementation of projects.

Practical: Exercises in project formulation and case studies.

Mgt. 543 Management of Research and Development 2+1 Sem.II
Role of research and development activities within business enterprises. Effective management of research and development functions - determining research and development needs of organization, establishing priorities, developing R & D plans and strategies, preparing budgets, characteristics of effective R & D programmes. Personnel, financial and accounting control, schedule control, project evaluation and corrective action.

Practical: Case studies, analysis and discussion.

Mgt. 544 Managing E-Business 3+0 Sem.I

Mgt. 545 E-Commerce Technologies 2+1 Sem.I
Practical: Practicals related to Internet and Intranet browsing, downloading and development of internet and intranet based business solutions. Case studies related to E-business and technologies used therein.

Mgt. 546 Data Management for Decision Makers 2+1 Sem. II

Practical: Applications in RDBMS for business solutions.

Mgt. 547 Current Issues in E-Business 3+0 Sem.II
Latest developments in the area of e-business/e-commerce and e-governance including technical, legal and behavioural issues. Impact of these issues in the overall business environment and emergence of various opportunities and threats. Development of Strategies.

Mgt. 601 Management Thought 2+0 Sem.I

Mgt. 602 Comparative Management 2+0 Sem.II

Mgt. 603 Advanced Financial Management 3+0 Sem.I

Mgt. 604 Management Information and Control Systems 3+0 Sem.II
Management information systems - perspectives, management information needs, purpose, scope, design of management information systems, major and minor management information systems, need for control, need for management training, implementing management information systems, problems and pitfalls, simulation and information retrieval, management information systems and automation, managerial interference, technology and foundation of management information systems. Management Control Systems-profit planning and control, sales, production and expenses, performance reports for management control.

Mgt. 605 Advanced Accounting Theory and practice 3+0 Sem.II
Accounting theory and accounting profession, methodology of accounting theory, development of accounting theory, accounting objectives, concepts, measurements and structure of accounting theory, international accounting standards, concepts of income reporting. Theoretical evaluation of revenues and expenses,

Mgt. 606 International Financial Management 2+0 Sem. I

Mgt. 607 Financial Reporting 2+0 Sem.I

Mgt. 608 Statutory Cost and Management Audit 2+0 Sem.II
Auditing philosophy, audit objectives and techniques, principles of auditing, methodology of audit, audit programme design, audit of cash and trading transactions, audit of impersonal and personal ledgers, balance sheet audit, verification and investigation of assets. Rights, duties sand responsibilities of an auditor. Independence in audit, concentration of audit, statistical sampling techniques and auditing. Cost audit-principles and procedure, audit and internal control, audit reporting problems. Management audit - problems in developing performance standards, management audit procedures and reporting on management audit.

Mgt. 609 Portfolio Management 2+0 Sem.I
Concepts of portfolio management, strategy of risks and returns, different approaches to portfolio management, personal portfolio management, portfolio management of investment companies, trusts, commercial banks, development institutions, insurance companies and pension funds. Role of computer in portfolio management.

Mgt. 610 Advanced Marketing Management 3+0 Sem.II
Development of marketing thought, marketing environment in India - Historical analysis, innovative marketing, marketing information, marketing productivity, cost and profitability. Productivity analysis of goods and services, customers and territories, advertising, distribution and field sales operations. Model building for analysis and interpretation of marketing data, deterministic optimizing models, stochastic process models, experimental designs, discriminant and canonical analysis, factors and cluster analysis, heuristic models, behaviour models.

Mgt. 611 Marketing Strategy 3+0 Sem.I
Marketing strategy, marketing mix strategies for consumer, consumer durables and non-durable goods, marketing strategies during stagflation and shortages, principles of marketing planning, planning systems, resources and objectives, corporate marketing strategies, forecasting, designing marketing, campaign facilities. Implementation of marketing strategies - organization system, testing a plan, performance analysis, efficiency control and marketing audit.

Mgt. 612 Retail and Wholesale Management 3+0 Sem. II
Mgt. 613 Marketing Legislation in India 2+0 Sem.I
Various central and states statutes and legislation. Evolution of various governmental regulations. Selected statutes such as MRTP Act, Essential Commodities Act, Quality, Price and Distribution Control Legislation, Pure Food Legislation, Trade Mark, Copyright and Patent Legislation.

Mgt. 614 Financial Strategies for Marketing Operations 2+0 Sem.II
Analytical and creative approach to financial dimensions of marketing decisions. Setting financial objectives of marketing functions in an organization, marketing investment and management. Financial analysis of decisions involving product service expansion, contraction and substitution, product service development, credit sales analysis, analysis for pricing decisions, financial aspects of promotion, sales force management and other marketing operations.

Mgt. 615 Systems Analysis 2+0 Sem.I
An overview of systems types, purposive systems, man made systems, cybernetics and systems models, control and analysis of hierarchical systems, adaptive systems and learning models, control theory of social and economic systems, mathematical models, decision frame work for systems evaluation, criteria for evaluating public planning programme and budgeting systems.

Mgt. 616 Project Management with PERT and CPM 2+0 Sem.I
Developing project network, time estimates and their distributions, basic scheduling computations, variations of basic scheduling computations, scheduling activities to satisfy resource constraints, time- cost trade-off procedures. An introduction to network cost control. PERT-statistical approach, critical path methods.

Mgt. 617 Inventory Management 2+0 Sem.II
Various types of inventory systems, maintaining smooth supply of raw-materials and finished products for production and marketing. Structure of optimal inventory policies, deterministic and stochastic models. Planning horizon theorem, parametric production planning, stochastic ordering, single critical level policies, myopia policies, Bayesian models, dependence of optimum policies in various parameters.

Mgt. 695 Advanced In-Industry training 0+7 (NC)
To provide in-depth knowledge of the field problems and actual operation of business organization, the student will be sent for in-industry training for 6-8 weeks and will be required to submit training report and collect cases. This will form the basis of evaluation.

Mgt. 595 In-Industry Training 0+5 (NC)
Each student is required to undergo "In-Industry Training" in a business organization for six weeks. The purpose is to expose the students to the practical aspects of management. At the end of the training programme, the student is required to submit a report. This report and the overall performance of the student in the organization form the basis of evaluation of student's work.

Mgt. 591 Seminar
Mgt. 600 Project Research
Mgt. 700 Ph.D. Research

ABM 501/ Mgt. 501 Principles of Management and Organizational Behaviour 3+0 Sem.I
Concept of organization and organizational behaviour. Management-definition, scope, importance and functions of management. Development of management thought- Taylor's scientific management, Fayol's principles of management, Human Relations Approach etc. Planning and decision making, types of plans and planning process. Principles of planning, Management By Objectives (MBO). Organization structure - departmentation and its basis, span of management and factors influencing span of management, delegation of authority, line, staff and functional relationships. Role of behavioural sciences in organization. Individual behaviour, interpersonal and group behaviour. Motivation - concept, different theories of motivation, and motivational factors. Transactional analysis and group dynamics. Perception and defence mechanism,

ABM 502/Mgt. 502 Business Environment 3+0 Sem.II

ABM 503/Mgt. 503/Econ. 501 Managerial Economics /Micro Economics 3+0 Sem I

ABM 504/Mgt. 504 Managerial Accounting and Control 2+1 Sem.I
Practical: Numerical problems, case studies: analysis and discussion.

ABM 505/Mgt. 505 Marketing Management 3+0 Sem.I
Introduction to marketing management, marketing concepts, managerial functions of marketing. Market and marketing environment, a review of existing Indian marketing environment, strategic marketing. Market segmentation- bases for segmenting consumer and business markets, targeting and positioning, marketing mix. Buyer behaviour -decision making process in marketing, marketing decision criteria and techniques. Marketing information system, marketing organization and control. Marketing potential and forecasting. Product strategy - product life cycle, new product development, product line and product mix, branding, packaging and labeling. Designing and managing services - Managing service quality, managing service brands. Pricing strategy- factors affecting prices, pricing policies and strategies, pricing methods. Channel strategy- types of distribution channels, functions of channel members, channel conflicts, channel
management decisions. Promotion strategy- promotion mix, introduction to advertising, personal selling, sales promotion, publicity, public relations and direct marketing. Managing integrated marketing promotion, Customer relationship management.

ABM 506/ Mgt. 506 Human Resource Management 3+0 Sem.II

ABM 507/ Mgt. 507 Financial Management 3+0 Sem II

ABM 508/Mgt. 508 Production and Operations Management 3+0 Sem II
Nature and scope of production and operations Management- its relationship with other systems in the organization. Production functions, work and job design, facilities planning, product and process selection. Product design and development- importance of product design, characteristics of good design, technical process of new product development, design for manufacture, concurrent engineering. Facilities location- importance, location analysis techniques, facilities layout and materials handling of various agricultural products. Capacity planning- measuring capacity, process of capacity planning, methods for altering capacity in long term and short term. Production planning and control for different types of manufacturing systems related to agri-business, planning and control of projects, work study, method study, work measurement, work sampling, maintenance management, value engineering, quality assurance and quality circles. Total quality management, commodity purchase system and purchase principles, inventory management, stores management, food grading, packaging, standardization, codification, quality control, certification systems and agri-waste management.

ABM 509/ Mgt. 509 Research Methodology in Business Management 2+1 Sem II
Introduction to research methodology, research process, identification and formulation of problem. Research designs- exploratory research design, descriptive research design including cross-sectional design and longitudinal design. Secondary data, primary data, survey techniques and observation. Causal research design - experimentation, classification of experimental designs. Measurement and scaling techniques- nominal scale, ordinal scale, interval scale, ratio scale. Comparative scaling: paired comparison scaling, rank order scaling, constant sum scaling. Non-comparative scaling techniques - likert scale, semantic differential scale, stapel scale. Questionnaire design. Sampling design and procedures. Non-probability sampling techniques - convenience sampling, judgmental sampling, quota sampling and snowball sampling. Probability sampling techniques - simple random sampling, systematic sampling, stratified sampling.

Practical: Case discussions, data collection, tabulation, analysis and report writing. Use of statistical packages for agribusiness solutions.

**ABM 510/ Mgt. 510 Strategic Management** 3+0  Sem II

**ABM 511/ Mgt. 511 Management Information System** 2+1  Sem I
Concepts, needs and scope of Management Information System (MIS) in business organization. Understanding business as a social system and information approach to management and organization theory. Types of management information systems- transaction processing systems, office automation systems, decision support systems, executive support systems, knowledge based expert systems. Business process reengineering, design and implementation of MIS. Components of MIS, system flow charts, developing data base, integration of sub-systems, developing organization structure for MIS, MIS and control system. Enterprise Resource Planning (ERP)- concepts, selection & implementation, and key success factors for ERP use, aligning strategy & information systems. Use of internet in agribusiness. GIS and remote sensing.

Practical: Use of software packages and simulations for agribusiness decision making, use of word processor for report writing and business correspondence, use of spreadsheets for problem solving and analysis of business situations, use of presentation graphics for making business presentations, use of internet and search engines.

**ABM 512/ Econ. 508/ Mgt. 512/Stat. 527 Quantitative and Optimization** 2+1  Sem II
Techniques for Economics and Management
Role of quantitative methods in decision making, probability and decision making under risk and uncertainty, the value of additional information, Bayes theorem, probability models and decision making. Sample survey methods, measurement and forecasting, index numbers, time series analysis, optimization models, linear programming: formulation and simplex method, primal and dual, sensitivity analysis, transportation models and assignment models, dynamic programming, network analysis, PERT and CPM. Game Theory: concept, Two person constant sums, zero sum games, saddle point, solution to mixed strategies, Markov chain analysis, Queuing models- waiting line problem, characteristics of waiting lines, single-channel model, multiple-channel model, constant-service time model, finite population model, sequencing and replacement models. Simulation and Monte Carlo methods.

Practical: Graphical and algebraic formulation of linear programming models, Solving of maximization and minimization problems by simplex method. Formulation of simplex method by typical farm situations, Solution of other numerical problems, case studies, analysis and discussion.

**ABM 513/ Mgt. 513 Project Management and Entrepreneurship Development** 2+1  Sem II
Concept and nature of agro-industrial projects, characteristics and types of projects. Generation, identification and screening of project ideas, project life cycle. Formulation of agro industrial projects - market and demand, technical and financial feasibility, methods for evaluation and ranking of projects, risk analysis for
agro-industrial projects, impact of inflation on projects, preparation of feasibility report. Financing of agro-
industrial projects, sources of finance and structure of financial institutions related to agribusiness, venture
capital. Central and state incentives for agribusiness. Implementation of project: network methods, project
scheduling and resource allocation, project control and information system, monitoring and feedback,
operational problems in implementation of agribusiness projects. Entrepreneurship, Significance of
entrepreneurship in economic development, qualities of an entrepreneur, entrepreneurship development
programmes and role of various institutions in developing entrepreneurship, lifecycle of new business,
environmental factors affecting success of a new business, reasons for the failure and visible problems
for business, developing effective business plans, procedural steps for setting up an industry.

Practical: Exercises in project formulation, numerical problems related to project evaluation, risk analysis
and case studies.

ABM 514 Rural Marketing Management 2+0 Sem I
Rural marketing- concept and importance, characteristics and structure of rural markets, problems in rural
marketing. Environmental factors affecting rural marketing- socio-cultural, economic, demographic,
technological and other factors. Rural consumer behaviour, customer relationship management, rural market
research. Rural marketing strategies- segmenting, targeting, positioning of rural markets, product
planning, product mix, pricing policy and pricing strategy. Distribution and promotion strategies for rural
markets- Rural communication and problems. Marketing of agricultural inputs, consumer durables and
farm produce. Packaging, transportation, grading and standardization, storage and processing of agricultural
produce, financing for rural marketing, marketing agencies and institutions for rural markets, innovation in
rural marketing.

ABM 515 Management of Food Processing Industry 2+0 Sem II
Overview of food processing industry scenario in India, world trade in processed foods- prospects and
challenges. Present status of food industry, deteriorative factors and hazards during processing,
storage, handling and distribution. Management of functional areas of food processing units- capacity
planning, sourcing of raw material, scope of contract farming, problems faced by food processing units,
packaging of foods. Analysis of costs in food organization, risk management. Laws and regulations related
to food industry and food production and marketing. Quality management- quality standards, PFA and
ISO. Case studies on project formulation in various types of food industries- milk and dairy products, cereal
milling, oil-seed and pulse milling, sugarcane milling, honey production, baking, confectionary, oil and fat
processing, fruits and vegetable storage and handling, processing of fruits and vegetables, egg, poultry,
fish and meat handling and processing.

ABM 516 International Trade and Marketing for Agribusiness 3+0 Sem I
Introduction, scanning the international environment for agribusiness, composition of international trade-
comparative and competitive advantage, recent trends in world trade and India's foreign trade in the area of
agribusiness. India's foreign trade policy and its importance for developing economy, instruments of
trade policy - quotas, antidumping duties, quantitative and qualitative restrictions, tariff, non-tariff measures
and trade control, India's balance of payments, exchange rate. WTO and its agreements, implications of
WTO for Indian economy and agriculture sector in particular, TRIPS, TRIMS, subsidies- green and red
boxes, countervailing duty measures, carbon trade, SPS agreement. Regional economic groupings, export
promotion institutions with special emphasis on EPCs and commodity boards, MPEDA, APEDA and
service institutes. Import- export documentation, role of ECGC in insurance, identifying foreign markets
for agri products, international marketing - market entry methods, international product planning, pricing,
promotion, distribution, problems of exporters, legal dimensions of international marketing. Exercises in
international agribusiness management, case studies.

ABM 517 Supply Chain Management 3+0 Sem I
Supply chain- changing business environment. Supply Chain Management (SCM)- present need, conceptual
model of SCM, evolution of SCM. Concept and significance of physical logistic and distribution system as
applicable in agribusiness, marketing and physical distribution process, elements of physical distribution
system, transportation and its relation to plant location, warehousing and inventory, modes of transportation, optimum relationship between size and frequency of shipments, transportation model, Vendor Managed Inventory (VMI), third-party logistics, GPS technology. Supply chain management in agri-business, procurement management in agri supply Chain - purchasing cycle, types of purchases, contract/corporate farming, Various models of supply chain management as followed by developed countries. Cost analysis and logistic system design, organisation and management of physical distribution and supply chain. Concept of Information Technology (IT) - IT Applications in SCM, SCM in electronic business, role of knowledge in SCM. Performance measurement and controls in agri supply chain management.

**ABM 518 Marketing of Agricultural Inputs**  
Agricultural input marketing: meaning and importance, management of distribution channels, agricultural inputs and their types, role of cooperative, public and private sectors in agri input marketing. Seed - importance, types of seeds - hybrid, high yielding and quality seeds. Demand and supply, marketing channels, pricing, export and import. Role of NSC and State Seed Corporation. Chemical fertilizers - production, export-import, supply, demand and consumption, pricing policy, subsidy, marketing system, problems in distribution. Role of IFFCO and KRIBCO. Plant protection chemicals - production, export/import, consumption, marketing system. Farm machinery - production, supply, demand, marketing and distribution, agro industries corporation and marketing of farm machines implements and equipments.

**ABM 595 In-Industry Training**  
Each student is required to undergo in-industry training in a business organization for six weeks. The purpose is to expose the students to the practical aspects of management. At the end of the training program, the student is required to submit a report. This report and the overall performance of the student in the organization form the basis of evaluation of student's work.

**ABM 591 Seminar**

**ABM 600 Project Research**
CHEMISTRY

PROGRAMMES
M. Sc.
Ph.D.
Five Year Integrated M.Sc. (Hons.)

COURSE REQUIREMENT
M.Sc.
Field of specialization
Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Agrochemicals

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
Botany, Biochemistry, Microbiology, Mathematics, Statistics, Physics, Entomology, Plant Pathology, Soils, Agronomy or any other as approved by the Dean Postgraduate Studies.

Deficiency courses
As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.
Field of specialization
Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Agrochemicals

Required courses
Chem. 601

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

Minor fields
Botany, Biochemistry, Microbiology, Mathematics, Statistics, Physics, Entomology, Plant Pathology, Soils, Agronomy or any other as approved by the Dean Postgraduate Studies.

Deficiency courses
As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Five Year Integrated M.Sc. (Hons.)
Field of specialization
Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Agrochemicals

Required courses
All courses listed for Semester I-VI (P-496) and Chem.501, Chem.502, Chem.503, Chem.504, Chem.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, Microbiology, Mathematics, Statistics, Physics, Entomology, Plant Pathology, Soils, Agronomy or any other as approved by the Dean Postgraduate Studies.

Deficiency courses
As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies
DESCRIPTION OF COURSE CONTENTS

Undergraduate courses

Chem.91 Chemistry-I  
3+1  Sem. I

Some basic concepts of chemistry. Atomic Structure. Classification of elements and periodicity in properties.
Chemical bonding and molecular structure. Some s-, p- d- and f- block elements. Coordination compounds.
Chemical energetics and thermodynamics. Chemical kinetics. Redox reactions.
Electrochemistry and electrochemical cells. Solution and colligative properties. Acids, bases, salt, pH,
common ion effect and buffer solutions. Salt hydrolysis and solubility products.

Practical: Determination of one cation and one anion in a given salt. Crystallization involving impure sample of one of the following: alum, copper sulphate.
Determination of strength of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.
Determination of strength of a given solution of hydrochloric acid by titrating it against standard sodium carbonate solution.
Determination of concentration / molarity of potassium permanganate solution by titrating against a standard solution of (i) Oxalic acid (ii) Ferrous ammonium sulphate.

Chem.92 Chemistry-II  
3+1  Sem. II

Purification and characterization of organic compounds. Classification and nomenclature of aliphatic and aromatic compounds. Isomerism, steric hindrance, inductive effect and resonance. Organic reactions and their classification.
Alkanes, Chemistry of aromatic hydrocarbons, cycloalkanes, alkenes, alkynes and alkadienes. Methods of preparation, physical properties, reactions and important uses of haloalkanes, haloarenes and aromatic and aliphatic compounds containing hydroxyl, ether, aldehydes, ketones, carboxylic acid, nitro, amino and cyano functional groups. Aliphatic and aromatic carboxylic acid derivatives.
Preparation and properties of diazonium salts.

Practical: Determination of melting point of organic compounds. Determination of boiling point of organic compound.
Detection of elements and tests for functional groups present in organic compounds.
Preparation and study of some important organic compounds.

Chem.101 General Chemistry  
2+1(NC)  Sem.I


Chem.102 Introductory Organic Chemistry  
2+1  Sem. I

Introduction to organic chemistry. IUPAC nomenclature of carbon compounds and their isomerism in carbon compounds, hybridization, sp³, sp² and sp, their shapes and angles, explanation of acidity of alkynes. Preparation and properties of alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, aliphatic aldehydes and ketones, aliphatic carboxylic acids and their derivatives and aliphatic amines.
Introduction to aromatic compounds. Structure of benzene, aromatic hydrocarbons, preparation and properties of benzene, ary halides, phenol, aniline, benzene sulfonic acid, benzaldehyde, acetophenone, benzoic acid. Chemistry of esters, amides, acid chlorides, cyanides and isocyanides.

An introduction to substitution and elimination reaction, carbocations, carbanions and free radicals.

Chem. 201 Organic Chemistry 3+0 Sem. I

Chem. 202 Chemistry for Agricultural Engineering 2+1 Sem. II

Chem. 203 Physical and Inorganic Chemistry 2+1 Sem. I, II

Chem. 204 Mechanism of organic reactions 2+1 Sem. II
Chem.205 Engineering Chemistry 2+1 Sem. I

Chem.301 Fundamental Organic Chemistry 3+0 Sem. I

Chem.302 Chemistry of Agrochemicals, Plant Products and Growth Regulators 1+1 Sem. I
Organic chemistry as prelude to agrochemicals. Diverse types of agrochemicals. Botanical insecticides (neem), pyrethrum and synthetic pyrethroids. Synthetic organic insecticides, major classes, chemistry and use of some important insecticides under each class. Herbicides-major classes, chemistry and use of 2,4-D, atrazine, glyphosate, butachlor, benthiocarb. Fungicides - major classes, Chemistry and use of carbenzadim, carboxin, captan, tridemorph and copper oxychloride. Plant growth regulators. Practical: Argentometric and iodometric titrations - their use in the analysis of important pesticides. Compatibility of fertilizers with pesticides.

Chem. 303 Thermodynamics and Chemical Kinetics 3+0 Sem. II
Mathematical derivation of rate equation for zero, first and second order reactions, half life, Pseudo unimolecular reactions. Homogeneous and heterogeneous catalysis, Acid base & enzyme catalysis, Michaelis Mentan equation for enzyme catalysis.

Chem. 304 Basic Analytical Chemistry  
**3+0**  Sem. II  

Chem. 305 Experiments in inorganic Chemistry  
**0+2**  Sem. II  
Quantitative analysis of inorganic mixture of four (4) ions with one interfering anion. Chromatographic separation of Cl⁻, Br and I⁻; Cd²⁺ and Hg²⁺. Colorimetric determination of Ni as Ni-diglyoxime complex, Pb as dithiaozone complex and Al (or Mg) as oxinate complex. Preparation of aluminium acetylacetonate, Cu(I) thiourea, Potassium trioxalato chromate (III) and Mohr's salt.

Chem. 306 Fundamental Inorganic Chemistry  
**2+0**  Sem. I  

Chem.421 General Physical Chemistry  
**2+1**  Sem. I  

Chem.422 Electrochemistry and Surface Chemistry  
**3+0**  Sem. II  

Chem.423 General Organic Chemistry  
**2+0**  Sem. I  
Introduction to mechanism of various organic reactions including reaction intermediates, carbocations, carbanions, free radicals, carbenes and BENZENES. Stereochemistry, optical activity, chirality, compounds with one or more chiral centres, enantiomers, diastereomers, nomenclature and assignment of
configurations to simple molecules including RS, EZ, and DL. Conformations of acyclic and cyclic systems including staggered, anti, gauche and chair and boat forms. Chemistry of heterocyclic compounds, thiophenes, furan, piperidine, pyridine, pyrrole, pyran. Chemistry of oils, fats and carbohydrates.

Chem. 424 Radioactivity and Transition elements 2+0 Sem. I
Discussion of f blocks elements, lanthanides, actinides, lanthanide contraction, actinide contraction and its effects, separation of lanthanides and actinides, simple chemistry of elements like Francium, Technetium and Rhenium. Separation of inner transition elements, their salts and uses. Atomic nuclei, binding energy and stability of isotopes. Natural and induced radioactivity, kinetics and half life of radioactive elements, units of radioactivity, Carbon dating, transuranic series. Tracers and their applications. Acid-base concept, hard and soft acids and bases and the application of this concept. Role of transition elements in biological systems.

Chem. 425 Introduction to Metal Complexes and Chelates 2+1 Sem. II

Chem. 426 Chemistry of Non-transition Elements 2+0 Sem. I
Organometallic compounds of magnesium and copper and their synthetic utility, Latimer and Volt- equivalent diagrams, silicates, iso and heteropolyacids, boron hydride and related compounds, boron halides/sulfur-nitrogen cyclic compounds. Phosphates, oxy acids of nitrogen, phosphorous and sulfur and trends in their acidity and reduction potential, Ellingham diagram, Use of compounds of selenium and their toxicity. Xenon compounds, oxy and fluoro derivatives of xenon, their synthesis and chemical reactions structure of silicates and borates.

Chem. 427 Spectroscopy and Structure Elucidation 2+0 Sem. II
General introduction to principles and theory of various spectroscopic techniques, Infrared (IR) spectroscopy, group absorption, sampling techniques and interpretation of spectra. Nuclear magnetic resonance (H NMR and 13C NMR), Continuous wave (CW) and Pulsed Fourier Transform (FT) spectrometry, Chemical shift, Spin coupling, Chemical shift equivalence, Coupling constant, and Relaxation time. Difference in CW and FT techniques. Solvent shift and lanthanide shift studies. Theory and application of Ultraviolet spectroscopy, chromophore, auxochrome and red and blue shift, Study of Woodward rules and calculation of $\lambda_{max}$ of highly conjugated compounds like carotene and lycopene. Mass spectrometry, molecular ion peak, base peak, fragmentation pattern of simple molecules, hydrocarbons, alcohols, ethers alicyclic and cyclic ketones, aldehydes and McLafferty rearrangement. Combined use of spectroscopy for structural elucidation of simple organic compounds.

Chem. 428 Experiments in Chemistry 0+3 Sem. II
Chem. 429 Drugs, Bimolecules and Polymers 3+0  Sem. II

Chem. 430 Fundamental Quantum and Solution Chemistry 3+0  Sem. II
Elementary quantum mechanics, Black body radiation, Photoelectric effect, Bohr's model and its drawbacks, de Broglie hypothesis, Heisenberg's uncertainty principle, postulates of quantum mechanics. Schrödinger's wave equation, physical interpretation of wave function, particle in one dimensional box and three dimensional box, Schrödinger's wave equation for H atom, radical distribution function, Quantum numbers, n, l, m and their importance, Eigen value and eigen function, Hamiltonian operator, physical interpretation of wave function. Molecular orbital theory, Formation of molecular orbital by linear combination of atomic orbital, Calculation of energy levels from wave functions, Physical pictures of bonding and antibonding wave function. Colloids, preparation and properties. Zeta potential, emulsion, ionic equilibria, acids and bases, pH, buffer solution and Henderson's equation, salt hydrolysis, solubility product and its application. Adsorption and adsorption isotherms. Applications of adsorption, difference between physical and chemical adsorption.

Postgraduate Courses

Chem. 501 Thermodynamics and Electrochemistry 3+0  Sem. I

Chem. 502 Spectroscopy 2+1  Sem. I
Molecular structure-molecular orbital methods for H₂ and H₂ molecule, the valence bond description H₂; electron spin functions; correlation diagram for diatomic molecules. Huckel method for calculating resonance energy, rotation and vibration of molecules-linear and non-linear molecules, derivations of energy levels, selection rules. Rotational vibrational spectroscopy, rotational and vibrational level corrections, electron spectroscopy; Raman Spectroscopy, Laser Raman Spectroscopy. Nuclear Magnetic Resonance Spectroscopy, FTNMR. Mass spectroscopy. Practical: Application of spectroscopy for structural studies. Determination of structure of simple compounds by the combined use of UV, IR , NMR and Mass spectroscopy; use of double irradiation, solvent shift experiments on compounds having hydroxyl groups, inter and intra hydrogen bond studies by FT-IR.

Chem. 503 Basic Concepts of Inorganic Chemistry 2+0  Sem. I
Review of the atomic structure-wave mechanical approach, wave functions for hydrogen atom, radial distribution curves for s, p, d and f orbitals, angular wave functions for s, p, d and f orbitals-their significance and use. Slater-type orbitals; effective nuclear charge, use of radial distribution curves to explain order of
filling of orbitals in many electron systems, review of chemical bond. Application of VB, MO and VSEPR theories in explaining the structure of simple molecules. Rules for classification of molecules into point groups, group multiplication tables, degenerate and non-degenerate point groups, rules for fundamental vibrations. Inorganic free radicals-their general reactions, preparation and uses, measurement of free radical concentration and decomposition rate. Bio-inorganic chemistry, photosynthesis, metalloenzymes.

**Chem.504 Physical Organic Chemistry**  
2+0  Sem. I

Stereochemistry and conformation analysis-conformation and configuration, geometrical and optical isomers, methods of resolution, asymmetric synthesis. ORD and CD, aromaticity, steric effects, reactive intermediates, carbocations, carbanions, free radicals, carbenes, amines, nitrenes. Organic reaction mechanism: substitution, addition, elimination and rearrangement reactions. Substituent isotope solvent and kinetic salt effects, tracer technique. Hammett equation, non-classical carbocation ions. Neighboring group participation, pericyclic reactions and molecular orbital symmetry.

**Chem.505 Natural Product Chemistry**  
2+0  Sem. II


**Chem.506 Experiments in Physical Chemistry**  
0+2  Sem. II

**Practical:** Conductivity, potentiometry, pH metry, polarography, amperometric titration, spectrophotometry, flame-photometry, cryoscopic and ebullioscopic measurements; Chromatography. Adsorption studies, optical activity by polarimeter, refractive index and molar refraction of different solvents. Electron polarization of liquids refractrometrically, Kinetic studies.

**Chem.507 Quantum Chemistry-Statistical Mechanics**  
3+0  Sem. I


**Chem.508 Chemical Kinetics and Surface Chemistry**  
2+0  Sem. II


**Chem.509 Co-ordinate Chemistry, Reaction Mechanism and Inorganic Polymers**  
2+1  Sem. I

The theories of bonding in coordination compounds, valence bond theory, electroneutrality principle and back-bonding, crystal field theory and its application for understanding magnetic and spectral properties of metal complexes, structural effects of crystal field splitting (ionic radii, John-Teller effect). Thermodynamical effects of crystal field splitting (hydration, ligation and lattice energies). Limitations of crystal field theory, adjusted crystal field theory (ligand field theory), application of molecular orbital theory of square planar, tetrahedral and octahedral complexes, stability of complexes- methods of determination. Factors influencing stability, substitution reactions in octahedral complexes and associated stereochemical changes, redox reactions in coordination compounds and their mechanism. Transition metal complexes of π acceptor
ligands, inorganic polymers based upon homoatomic and heteroatom structures. Polymers containing boron and nitrogen, addition polymers of borazines, polymeric phosphorus compounds and condensed phosphates.

Practical: Preparation of inorganic complexes like $\text{Co(Hg(SCN)}_4$, $\text{Hg[Co(SCN)}_4$, $\text{[Co(NH}_3)_5\text{NO}_2\text{]}\text{Cl}_2$, $\text{Co(NH}_3)_3\text{Cl}\text{Cl}_2$, $\text{[Cu(}\text{Gly}_2\text{)]}$, $\text{K}_2\text{[Cu(C}_2\text{O}_4\text{)}_2\text{]}$, $\text{[Co(acac)}_3\text{]}$, $\text{K}_2\text{[Co}_2\text{(C}_2\text{O}_4\text{)}_4\text{(OH)}_2\text{]}$, $\text{[Co(NH}_3)_4\text{]}\text{SO}_4$ and $\text{Na}_3\text{[Co(N}\text{O}_2\text{)}_6\text{]}$. Determination of magnetic characteristic of above complexes. Analysis of alloys using conventional, physical and chemical techniques. Complex metric titrations.

Chem.510 Synthesis and Characterization of Organic Compounds 0+2 Sem. II

Chem.511 Chemistry of Agrochemicals I 2+1 Sem. I
Classification of pesticides on the basis of function, mode of entry and mode of action, chemistry and structural activity relationship of different pesticides. Insecticides-organochlorines, organo-phosphates, carbamates, pyrethroids, rotenones fungicides and botanicals. Fungicides-Inorganics, dithiocarbamates, Diazoles and Exothions. Herbicides-phenoxy compounds, substituted ureas, sulfonyl ureas, triazines, bipyridyldium compounds and dinotroanilines. Metabolic pathways of some important compounds of each chemical group. Chemistry of fertilizers.


Chem.512 Reaction, Reagents and Photochemistry 3+0 Sem. II

Chem.513 Chemistry of Transition Metals 2+0 Sem. I
Transition elements-Hund's rule and spectroscopic energy states, magnetism in transition metal chemistry, orgin and nature of paramagnetism, diamagnetism, erromagnetism and anti-ferromagnetism. Magnetic susceptibility and magnetic moment calculations, elements of second and third row transition series, chemistry of iso- and heteropolycyclics and anions of Mo and W, the metal-metal bonds. General remarks on different physical and chemical properties of compounds with two centered metal-metal bonds; metal clusters, occurrence, electronic structure, oxidation states and stereo chemistry. Magnetic and spectral properties of lanthanides and actinides, lanthanides contraction separation of lanthanides and actinides. Chemistry of rare elements francium, technitium, rhenium.

Chem.514 General Physical and Colloidal Chemistry 3+0 Sem. I

Chem.515 Chemistry of Agrochemicals II 2+1 Sem. II
Definition, importance, scope, basic principle of pesticide toxicology and its relationship with other disciplines. Structure, metabolism and mode of action of insecticides. Plant growth regulators. Role of chelates in

Chem.601 Special Topics in Chemistry  3+0  Sem. II

Chem.602 Advanced Physical Chemistry  3+0  Sem. II
Application of computers in Chemistry, Advanced quantum mechanics, Pauli's exclusion principle, interaction energy of electrons, method of directed valence bonds, molecular orbitals and valence, Application of statistical mechanics to reaction rates and intermolecular forces, Spectroscopy and solid state chemistry.

Chem.603 Organometallic Chemistry  3+0  Sem. II
Introduction, synthesis and structure of metal alkyls, metal aryls, metal carbonyls, metal carbenes and metal carbenes. Complexes with chain pi donor ligands and cyclic pi donor ligands, reaction pathways-association reactions, Substitution reactions, addition and elimination reactions, rearrangement reactions. Catalysis involving organometallic compounds-olefin hydrogenation, hydroformylation and the Wacker process. Polymerization, Fischer-Tropsch process, Cyclo-oligomerisation of olefins and acetylenes. Role of advanced spectroscopy in structure elucidation of complex organic compounds.

Chem.604 Bio-inorganic Chemistry  3+0  Sem. I
Inorganic elements in biological systems, importance of alkali and alkaline earth metals, ions and ligands affecting the stability of complexes. Coordinating sites in biologically important ligands such as purines, pyrimidines, nucleosides, nucleotides, amino-acids and peptides. Metalloenzymes and metal activated enzyme, metal complexes as oxygen carriers-haemoglobin, myoglobin, porphyrin. Oxygen carriers-hemocyanin and haemerythrin, synthetic oxygen carriers, non-redox metallo-enzymes. Mechanism of electron transfer reactions in metal complexes as drugs and anticancer agents.

Chem.605 Organic Synthesis and Spectroscopy  3+0  Sem. II

Chem.606 Constitution of Inorganic Compounds and Dynamics of Inorganic Reactions  3+0  Sem. II
Symmetry of crystals, crystal system, classes of crystals, types of lattices, lattice energy, point group and space groups, symmetry parameters, defects in solids. Structure of some typical binary and ternary compounds, structure of silicates, polyacids and their salts. Introduction to determination of crystal structure by X-ray diffraction, electron diffraction and neutron diffraction techniques. Thermodynamics, kinetics and spontaneity of reaction, Frost diagram and its relation to spontaneity and application in the prediction of chemical reactions.
Chemistry 507 Green Chemistry 3+0 Sem. I
Concept of green chemistry. Chemistry and chemical technology of waste, pollution, effluent and other environmental issues which are caused by chemical manufacturing. Novel synthetic techniques. Organic reactions involving reduction of raw material/solvent usage, milder operating conditions. Use of catalyst towards green chemistry. Reactions that uses heterogeneous or homogeneous catalyst leading to green scenario. Use of biocatalyst in reactions which make environment clean and friendly. Use of new reagents and solvents which are benign, environmentally friendly. Method of benign synthesis. Energy and renewable resources. Use of renewable raw material includes ethanol, bio-diesel, etc.

Chemistry 608 Advances in Agrochemicals 3+0 Sem. I

Chemistry 591 Seminar
Chemistry 600 Master's Research
Chemistry 700 Ph.D. Research
ECONOMICS AND SOCIOLOGY

A. ECONOMICS

PROGRAMMES

M.Sc. (Agricultural Economics)
Ph.D. (Agricultural Economics)

COURSE REQUIREMENTS

M.Sc.
Fields of specialization
Farm Management, Agricultural Marketing, Agricultural Finance

Required courses
Econ.501, Econ.502, Econ.503, Econ. 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
Statistics, Mathematics, Agri. Business Management, Business Management or any other as approved by the Dean, Postgraduate Studies.

Deficiency courses
As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D.
Fields of Specialization
Farm Management, Agricultural Marketing, Agricultural Finance.

Required courses
Econ. 601, Econ. 602, Econ. 603.

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

Minor fields
Statistics, Agri. Business Management, Business Management, Extension Education or any other as approved by the Dean Postgraduate Studies.

Deficiency courses
As recommended by the student's Advisory Committee and approved by the Dean, Postgraduates Studies
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Econ. 101 Principles of Agricultural Economics 2+0 Sem. II

Econ. 202 Production Economics, Farm Management and Agricultural Finance 1+1 Sem. II


Econ. 203 Introduction to Economics and Project Evaluation 2+1 Sem. I

Practical: Formulation of different types of projects relating to food technology, data collection, tabulation and their analysis in terms of various financial and economic criteria.

Econ. 303 Agricultural Marketing, Trade and Prices 1+1 Sem. I

**Econ. 428 Practices in Project Planning and Evaluation 0+3 Sem.II**
Preparation and monitoring of different kinds of projects concerning agricultural engineering and their analysis in terms of various economic feasibility criteria. Practices in management of farm resources, farm budgeting and accounting with emphasis on farm power and machinery, factor-factor, factor-product and product-product relationships. Practices in cost measurement and depreciation of agricultural machinery and other implements. Work experience in optimum decision making using farm management principles. Students will be guided regarding estimation of credit requirements, credit appraisal, credit use and repayment schedules for different agricultural enterprises and high-tech agriculture. Training in cost-benefit analysis, capital budgeting techniques, economic and financial analysis, pay back period, present value, internal rate of return, benefit cost ratios and sensitivity analysis on practical field situations. Visit to different types of markets and primary cooperative societies. Introduction to market orientation and demand forecasting techniques. Brief introduction of network analysis, inventory management and control. Training in estimation procedures of energy requirements in agriculture sector.

**Econ. 433 Micro Economic Analysis 3+1 Sem. I**
Micro Economics: meaning, definition, importance, nature and scope. Theory of consumer behavior: marginal utility analysis and indifference curve analysis. Demand analysis: meaning, definition, derivation of demand curve. Firm and industry: meaning, types, difference between firm and industry, equilibrium conditions, short-run and long-run analysis. Production: meaning, process and factors of production, relationship between production and different factors, production lags. Theory of producer behaviour: production function, costs, optimization of inputs use and product combinations, maximization of returns, specialization and diversification and supply analysis. Product market: meaning, types, assumptions, conditions of perfect and imperfect markets. Equilibrium of a firm and industry, determination of price and output of commodities under different market situations. Factor pricing: meaning, different theories for determination of rent, wages, interest and profit.

**Econ. 434 Macro Economic Analysis 3+0 Sem. I**

**Postgraduate Courses**

**Econ. 501 Micro Economics/Mgt. 503/ABM 503 Managerial Economics 3+0 Sem. I**
Price determination under various market situations: perfect competition, monopoly, monopolistic competition, oligopoly. Theories of distribution. General equilibrium theory. Welfare Economics.

**Econ. 502 Macro Economics and Policy** 3+0 Sem. I

**Econ. 503 / Mgt. 527 Econometrics** 2+1 Sem. II

**Econ. 504 Agricultural Production Economics** 2+1 Sem. I

**Econ. 505 Agricultural Marketing and Price Analysis** 2+1 Sem. I


Econ.506/Soc. 506/Ext.505/HEE 501 Research Methodology for Social Sciences 2+1 Sem. I


Econ. 507 Evolution of Economic Thought 2+0 Sem. I


Econ. 508/ MGT 512/ABM 512/ Stat. 527 Quantitative and Optimization 2+1 Sem. II

Techniques for Economics and Management

Role of quantitative methods in decision making, probability and decision making under risk and uncertainty, value of additional information, Bayes theorem, probability models and decision making. Sample survey, measurement and forecasting, index numbers, time-series, optimization models. Linear programming: Formulation of simplex method, primal and dual, sensitivity analysis. Transportation and assignment models, dynamic programming, network analysis, PERT and CPM. Game theory: concept, two person constant sums, zero-sum games, saddle point, solution to mixed strategies. Markov chain analysis, queuing models: waiting line problem, characteristics of waiting lines, single channel model, multiple channel model, constant service time model, finite population model, sequencing and replacement models. Simulation and Monte Carlo methods.

Practical: Graphical and algebraic formation of linear programming models. Solving of maximization and minimization problems by simplex method. Formulation of the simplex method by typical farm situations. Solution of other numerical problems, case studies and discussion.
Econ. 509 Agricultural Finance and Project Management 2+1 Sem. II
Practical: Estimation of demand and supply gaps of institutional agricultural credit. Preparation of farm credit plan and financial statements using farm/firm level data. Farm credit appraisal techniques and farm financial analysis through financial statements. Performance of micro financing institutions: NGO's and Self-Help Groups. Identification and formulation of agricultural investment projects. Practical training of project appraisal techniques: undiscounted and discounted measures along with their limitations. Case study analysis of an agricultural project, financial risk and risk management strategies.

Econ. 510 International Economics 2+1 Sem. I

Econ. 511 Agricultural Development and Policies 3+0 Sem. II
Econ. 512 Institutional Economics 1+0 Sem. I

Econ. 513 Natural Resource and Environmental Economics 3+0 Sem. II

Econ. 514 Rural Marketing 2+0 Sem. II
Concept and scope of rural marketing: nature, characteristics and potential. Environmental factors: socio-cultural, economic and other environmental factors affecting rural marketing. Rural consumer's behaviour: behaviour of rural consumers and farmers, buyer characteristics and buying behaviour. Rural vs/urban markets. Rural marketing strategy: marketing of consumer durable and non-durable goods and services in the rural markets with special reference to product planning, product mix, pricing course objective, pricing policy and pricing strategy. Input marketing in the rural areas. Inter linkage of rural marketing with credit. Product promotion: media planning, planning of distribution channels, and organizing personal selling in rural market in India.

Econ. 515 Commodity Futures Trading 2+0 Sem. I

Econ. 516 Farm Management Economics 2+1 Sem. II
Meaning and functions, development of farm management as a science, management factor in commercial agriculture. Organization and operation of the farm business for optimal resource use. Cost and returns concepts. Relationship between different farm enterprises. Farm adjustment programmes under uncertain conditions. Farm records and accounting. Efficiency measures for different types of enterprises and farm business.

Practical: Preparation of layout maps, maintenance of farm business records, summarization and analysis of the accounts and preparation of enterprise, labour and partial budgets, alternative plans and control charts in respect of the assigned farm.
Econ. 517 Money and Banking 2+0 Sem.I
Evolution of money. Nature and functions of money with special reference to the macro economic variables, various forms of money, changes in the value of money, monetary standards, role of commercial banks and other banking institutions. Principles and procedure of lending, documentation etc. Instruments of credit, structure and functions of a central bank in the context of economic planning, international monetary relations and institutional set up.

Econ. 518 Agribusiness Environment and Policy 2+0 Sem. I
Role of agriculture in Indian economy; problems and policy changes relating to farm supplies, farm production, agro-processing, agricultural marketing, agricultural finance. Structure of agriculture : linkages among sub-sectors of the agribusiness sector, economic reforms and Indian agriculture. Impact of liberalization, privatization and globalization on agribusiness sector. Emerging trends in production, processing, marketing and exports. Policy controls and regulations relating to the industrial sector with specific reference to agro-industries. Agribusiness policies: concept and formulation, and new dimensions in agri-business environment and policy. Agricultural price and marketing policies, public distribution system and other policies.

Econ. 519 Management of Agribusiness Cooperatives 3+0 Sem. II

Econ. 520/ Forst. 506 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 product 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.

Econ. 601 Advanced Micro Economic Analysis 2+0 Sem. II

Econ. 602 Advanced Macro Economics Analysis 2+0 Sem. II
Econ. 603 Advanced Econometrics 2+1 Sem. II

Econ. 604 Advanced Production Economics 2+1 Sem. II

Econ. 605 Quantitative Development Policy Analysis 2+1 Sem. I

Econ. 606 Advanced Agricultural Marketing and Price Analysis 2+1 Sem. I


**Econ. 607 Advances in Commodity Futures Trading**  
2+0  
Sem. II


**Econ. 608 Advanced Environmental Economics**  
2+0  
Sem. I


**Econ. 609 Advanced Agricultural Economics**  
3+0  
Sem. I

History of agricultural development. Theories of agricultural development. Agriculture in different countries with different social, political and economic systems. Institutional setting in agriculture, intersectoral forward and backward linkages. Agricultural development process under various economic systems. Distributional justice, distortions by political and economic factors, impact of agricultural development on investment, capital formation and employment, agricultural taxation, World trade in agriculture and external competitiveness. Review of agriculture policy and impact and institutional changes in agricultural development.

**Econ 610 Advanced Agricultural Financial Management**  
2+0  
Sem.I


**Econ. 591 Seminar**

**Econ. 600 Master's Research**

**Econ. 700 Ph.D. Research**
B. SOCIOLOGY

PROGRAMMES

M.Sc.

Ph.D.

COURSE REQUIREMENTS

M.Sc.

Fields of specialization: Rural Sociology, Social Change


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


Deficiency courses: As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph.D.

Fields of specialization: Rural Sociology, Social Change

Required courses: Soc. 601, Soc. 602

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

Minor Fields: Economics, Extension Education, Business Management, Human Development, Statistics or any other as approved by the Dean Postgraduate Studies

Deficiency Courses: As recommended by the student's Advisory Committee and approved by the Dean, Postgraduates Studies
## DESCRIPTION OF COURSE CONTENTS

### Undergraduate Courses

**Soc. 201 Rural Sociology and Human Psychology**  
2+0  Sem.I  

**Soc. 421 Applied Rural Sociology**  
3+0  Sem.II  

**Soc. 422 Rural Community Organization**  
2+0  Sem.II  
Structure and functions of rural community. Organizational and informal relationships. Process of making decisions and policy for community development through agricultural extension, school systems and other agencies. Handling a group project for the analysis of social structure. Formal and informal relationships. Decision making channels and authorities for suggesting an outline of the community action programme in a given problem area.

**Soc. 423 Society and Culture**  
2+0  Sem.II  
The meaning of society and culture, its significance for human being and its diverse forms. Interaction and its processes of growth. Social relations and organizations among selected people around the world including kinship, religious, fraternal, occupational and political forms of behaviour. Effects of environment on human behaviour.

**Soc. 424 Technology and Social Change**  
2+0  Sem.I  

**Soc. 425 Population and Society**  
2+0  Sem.I  

### Postgraduate Courses

**Soc. 501 Rural Society**  
3+0  Sem. I  
Soc. 502 Society and Change

Soc. 503 Sociological Theories

Soc. 504 Evolution of Social Thought

Soc. 505 Women Development Studies

Soc. 506/Econ.506/Ext.505/HEE.501 Research Methodology for Social Sciences
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 prioritization, research process. Hypothesis: meaning, characteristics, types and testing. Review of literature. Development of theoretical orientation of the research problem. Concept, construct, variables and their measurement. Sampling design, sampling error and methods of sampling. Research design and techniques. Types of data collection tools and testing their reliability and validity. Scaling techniques. Coding, editing, tabulation


**Soc. 507 Social Stratification**  
3+0 Sem. I

**Soc. 508 Rural Leadership**  
2+0 Sem. II

**Soc. 509 Human Ecology and Dynamics of Population**  
3+0 Sem. II

**Soc. 510 Development and Quality of life**  
2+0 Sem. I

**Soc. 601 Sociology of Development**  
3+0 Sem. II
Development and underdevelopment- Indian case. Evaluation and development of various institutions of simple and advanced societies. Social stratification and organizing principles of social life. Development efforts and their social, economic and environmental implications in post independence era. Global exposure and its effects on traditional social set up. Emergence of new institutions and their inter-relations.

**Soc. 602 Recent Advances in Rural Sociology** 3+0 Sem.II
Critical evaluation of the recent works of rural sociology. Contribution of sociology, anthropology, economics and psychology to the understanding of structure and functions of rural society. Change in development perspective, planning and social action and rural social policy, social values and developmental change, social spatial and economic limits of social change, socio-psychological variables in planned development. Formation and destruction of communities and rural development planning. Policy planning and administration concerning development of rural areas, family, child, women and marginalized sections. Evaluation of various programmes of rural development. Agricultural development and the farmers of the world: experience of developed and developing nations. Emerging social trends and their consequences in rural India. Land tenure and agrarian relations. Social structure and agrarian relations. Peasant unrest-causes and consequences. Role of migrant labour in agriculture. Rural indebtedness, farmer's suicides.

**Soc. 603 Contemporary Rural Social Problems** 3+0 Sem.I

**Soc. 604 Demographic Analysis** 3+0 Sem.I

**Soc. 605 Studies of Marginalized Sections** 2+0 Sem.II

**Soc. 606 Environment and Social Organization** 2+0 Sem-II
Soc. 607 Peasants Movements and Indian Agrarian Structure  2+0  Sem-II

Soc. 608 Society in India  2+0  Sem-II

Soc. 591 Seminar
Soc. 600 Master’s Research
Soc.700 Ph.D. Research
A. JOURNALISM

PROGRAMMES

1. MJMC (Masters in Journalism and Mass Communication)
2. PGDAJMC (Postgraduate Diploma in Agricultural Journalism and Mass Communication)

COURSE REQUIREMENTS

MJMC

Field of Specialization: Journalism and Mass Communication

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

Supporting Courses: PGS 501 and any other subject relating to area of special interest and research problem.

Minor fields: Extension Education, Economics, Sociology, Business Management or any other as approved by the Dean

Deficiency Courses: As recommended by the student's Advisory Committee and approved by the Dean, Postgraduates Studies

PGDAJMC

Required Courses: DJMC 501, DJMC 502, DJMC 503, DJMC 504, DJMC 505, DJMC 506, DJMC 507, DJMC 508, DJMC 509, DJMC 510
### DESCRIPTION OF COURSE CONTENTS

**Jour. 501 Print Journalism**  
*1+2*  
Sem. I  
Introduction to journalism; basic terminology; history of Indian press and printing; printing processes; attributes of a reporter; news syndicates and agencies; concept, sources and elements of news; press releases; flash messages; kinds of feature; feature, article and editorial writing; types and sources of editorials; principles of editing; headline writing; illustrations; principles of design and layout; brief introduction to recent trends in mass media; cultural imperialism, media activism, agenda setting, gate keeping, page 3 journalism.

Practical: Writing letters to the editor; newsgathering; writing news and headlines; conducting interviews; writing specially stories; planning and writing features and articles; news interpretation; editorial writing; proof reading and copy editing; use of appropriate computer applications for Desk Top Publishing; dummy making; page making; production of lab journal.

**Jour. 502 Online Journalism**  
*2+1*  
Sem. II  
Introduction to online journalism; basic terminology; a technical history of the Web and early online media; comparative media characteristics (print and online); online writing and story structure; issues in online research and information gathering; concept of interactivity and its tools; ethical dilemmas in online journalism; blogging and participatory journalism; issues concerning blogging; online advertising; virtual community formation v/s atomization; massification v/s individuation of news; understanding difference between web edition and e-edition of newspapers; metajournalism; extensions of new media e.g. RSS feeds, podcasting and wireless paper; convergence.

Practical: Uses of Internet; using search engines such as Google effectively; finding useful information from local, national and international sources; content writing; news-site designing; making a webpage using HTML/Front page.

**Jour. 503 Media Planning and Advertising**  
*2+1*  
Sem. I  
Introduction to advertising: its origin and growth; terminology. Advertising: classification, objectives, strategies at different levels and its future; marketing mix, promotional mix and the communication process; structure of advertising industry - advertising agencies; advertising coverage; types of advertising media; advertising codes, regulations and ethics; consumer redress forums; advertising and social issues; controversial advertising; issues concerning surrogate advertising; constructing an advertisement; types of consumers and buying motives; media selection and scheduling; difference between advertising and PR; media planning and buying; brand positioning.

Practical: Preparing media-specific advertisement copies; ad layout and design; computer graphics using appropriate applications.

**Jour. 504 Agricultural and Development Journalism**  
*1+1*  
Sem. II  
Meaning, scope and importance of development journalism; problems of rural development; development agencies; development media theory and democratic participant theory; dominant paradigm v/s participatory approach; human development index; making sense of development statistics; determinants of development; nation building and uplifting quality of life; agriculture and rural development schemes; agricultural news story structure, agricultural media dynamics and ethics; editing scientific papers, policy reports; public understanding and media coverage of environmental issues; use of traditional media; rural press; contribution of vernacular press; role of IT in agricultural and rural development. Right to communicate and New World Communication Order; WTO.

Practical: Planning and writing development articles; news and information material on farm, home and community activities; editing of popular leaflets and bulletins based on technical material; media mix campaigns for specific targets.

**Jour. 505 Media Ethics and Press Laws**  
*3+0*  
Sem. II  
Ethics - ethical reporting, code of ethics; social responsibility; invasion of privacy; sting operations and
ethical issues; organizational pressures in media ethics; six fundamental rights - right to equality, freedom; especially freedom of speech and expression, against exploitation, religion, cultural and educational rights, constitutional remedies; freedom and accountability of press; press laws in India; Official Secrets Act 1923: extent, application, definitions and penalties; laws of sedition; defamation - criminal and civil law, exceptions and liabilities, libel and slander; Contempt of Court Act 1971 - defences and punishment; Contempt of Legislature; Privileges of the Parliament and Press; Press Council Act 1978: composition, term, objects and functions, power to censure; Press Commission; Copyright Act 1957: meaning, term and infringements; registration of journals - Press and registration of Books Act 1867; Information Technology Act 2000 and cyber rights; Right to Information Act 2005; media's role in promotion of human rights; editor's freedom; case studies.

Jour. 506 Communication Theories and Research Techniques 2+1 Sem.I
Definition, scope and importance of communication; kinds of communication: intra- personal, interpersonal, group and mass communication, verbal and non-verbal communication; barriers of communication; communication process; diffusion process: one step, two step and multi step flow; communication models; theories: cognitive dissonance, selective exposure, perception and retention, uses and gratification approach, cultivation approach; research methods and practices for mass media; types of research: survey research, readership studies, content analysis, etc.; selection and formulation of research problems; method and style of writing research report.
Practical: Selecting a problem; conducting field surveys; writing reports; research proposal writing; conducting pilot studies and presenting reports.

Jour. 507 Corporate Communication and Public Relations 2+1 Sem.I
Corporate communication: concept, definition, nature and scope; effective means of organizational and social communication; differences between corporate communication and publicity, propaganda, advertising and lobbying; corporate citizenship and culture; function of consultancies/image advisories; event, crisis, image and conference management; counselling, issue support; direct marketing; budgeting; business communication; publics for corporate communication; media management: principles, ownership and organizational structure in management and editorial department; circulation department; definition and scope of public relations; tools and techniques of PR; use of print media, audio-visual aids and electronic media in PR; role of public relations in various institutions; public opinion, propaganda and PR; ethics in PR.
Practical: Organizing exhibitions and campaigns; organizing conferences; image management of university/college/department; media counselling and ghost writing for organizational heads; conducting visits; motivational campaigns for organizational staff; business correspondence; liaison with administration; space marketing features; making posters, hand bills for PR campaigns.

Jour. 508 Photojournalism 1+2 Sem.I
Photojournalism: brief history and technological developments; role of photography in communication; importance and impact of pictures in publications; understanding a photograph; qualities of a good photograph; reproduction qualities of a photograph; selection and editing of photographs; writing captions; ethics of photojournalism; legal limitations of a photojournalist. Ethics and aesthetics of image manipulation.
Practical: Camera basics; terminology; components and controls in a camera; types of camera; choosing a camera; importance of lighting and natural/artificial lighting; handling a camera; camera techniques; shutter, aperture and lens controls; elements and composition; developing and printing of photographs; digital photography; file formats and storage; image editing/manipulation in Photoshop; printing and printers; photo sharing via internet; photo galleries, preparing photo features.

Jour. 509 Broadcast Journalism 1+2 Sem.I
Principles and characteristics of broadcast journalism; its comparison with print journalism; basic terminology in radio and TV journalism; history of radio and TV; early experiments and inventions; ethics in broadcasting; organization and functioning of radio and TV stations; writing for rural radio and TV programmes; differences between ham, community and FM radio; evolution of Internet Protocol TV (IPTV); steps in production including pre and post production stages; creating effective newscasts; narrowcasting vs broadcasting; role of electronic media in rural development; impact of broadcasts and telecasts on rural life; problems of broadcasting/ telecasting.
Practical: Handling video camera; conceptualizing, drafting, interpreting and writing a radio script; drafting, interpreting and writing a TV script; preparing interview schedule for a radio/TV programme; scripting a radio/TV talk; reporting of university activities; accomplishments and research highlights through electronic media; editing scripts for development programmes on radio and TV; preparing a short documentary film.

Jour. 591 Seminar

Jour. 595 Training in Journalism 0+10 (NC)
For practical training, students will be attached to a newspaper/new agency/radio/TV for eight weeks.

Jour. 600 Project Research

PGDAJMC

DJMC 501 Print Journalism-An Introduction 2+2 Sem. I
Journalism: types, functions. News: elements, types, structure, sources, dateline, parts; headline: functions, characteristics, types; lead - 5Ws and one H; reporting: tips for gathering/writing news; fundamentals of good writing, re-writing; golden rules for journalistic writing. Feature: concept, formulation, types and placement, feature and news stories, article, planning and collection of information, feature syndicates, popular news- cum-feature agencies. Editorials: fundamentals of editing; interview, qualities of a good interviewer; role of illustrations, handling of photographs. Newspaper basics: front page, column, back page, editorial page, op-ed page; print line; stylebook; newspaper organization; slogans; supplements; documentation. Freelancing: choice of topics, columnist. Duties and responsibilities of press. Practical: Reading newspapers and clipping the stories, headlines; search for common journalistic language. Writing letters to the editors of newspapers and magazines; writing news, headlines and photo-captions; study print lines of various newspapers; map supplements of different newspapers; media watch: search for mistakes, duplication etc; conducting interviews; planning and writing of features, articles and editorials; copy editing; visit to printing press; study of basic printing process.

DJMC 502 Online Journalism 1+1 Sem. II
Introduction to new media; evolution and forms of online journalism: Push, Pull and Hybrid strategy; traditional vs. online journalism; characteristics; content writing and editing; investigative reporting and ethics in online journalism; virtual community formation vs. atomization. ICT: virtual learning, multimedia content development, decision support system in dissemination of agricultural news; media convergence. Practical: Use of Internet for the purpose of research, uploading, downloading, file transfer; writing content for an online media; understanding HTML and designing a basic webpage; chunking of information for a webpage; search engines; e-mail, news-groups, content writing; online transmission of news and pictures; online feedback system; web publishing.

DJMC 503 Agricultural and Science Communication 1+1 Sem. I
Meaning, scope and importance of agricultural and development journalism. Science journalism: concept and elements; attributes of a science reporter; problems of rural development; nation building and uplifting quality of life; agriculture and WTO regime; use of traditional media; rural press; contribution of vernacular press; role of IT in agricultural and rural development. Practical: Study of existing farm literature; investigating, collecting and analyzing agricultural content for mass media; planning and writing development articles; writing news and gathering authentic information material on farm, home and community activities. Understanding a science based issue; gathering, analyzing and writing science stories; writing radio/TV script for a science programme.

DJMC 504 Media Laws and Human Rights 2+0 Sem.II
Fundamental rights, especially freedom of speech and expression; freedom and accountability of press; official secrecy; laws of sedition; defamation; libel; slander; contempt of court; contempt of legislature; press council; copyright laws; registration of journals; Information Technology Act-2000 and cyber rights. Human Rights: concept, definition and scope; media as a tool to promote human rights. Right to Information Act 2005.

DJMC 505 Electronic Journalism 1+1 Sem.I
Principles and characteristics of radio/TV journalism; history of broadcasting in India and history of telecasting
in India; organization of radio stations; organization of TV stations script writing for rural radio programmes; script writing for rural TV programmes; electronic media especially radio and TV in rural development.

Practical: Reporting of university activities; reporting of university’s accomplishments and research highlights to All India Radio and Doordarshan Kendra; planning, preparing and editing scripts for development programmes on radio, planning, preparing and editing scripts for development programmes on TV.

**DJMC 506 Corporate Communication, PR and Advertising**  
1+1  
Sem. II

Introduction to corporate culture; corporate citizenship; outsourcing in corporate communication; definition, scope, ethics, tools & techniques of public relations; role of PR in various institutions; public opinion; propaganda; types of advertising media; media selection and scheduling; difference between advertising and PR; advertising codes and ethics; constructing an advertisement; event management.

Practical: Business correspondence; space marketing features; developing an advertisement idea; understanding the use of sound and jingle in and advertisement; conceptualizing, designing and making posters; developing a campaign to promote corporate citizenship and brand image; preparing pamphlets and hand bills for PR campaigns; preparing media-specific advertisement copies.

**DJMC 507 Photo-Journalism**  
1+1  
Sem. I

Photo journalism, role of photography in communication; importance and impact of pictures in publications; understanding a photograph; qualities of a good photograph. Camera terminology; components and controls in a camera; handling a camera; camera reproduction qualities of a photograph; selection and editing of photographs; writing captions; photo editing; legal limitations of a press photographer; maintaining a photo-library.

Practical: Techniques; elements and composition; developing and printing of photographs; digital photography; image editing/manipulation in Photoshop; photo sharing via internet; photo galleries, preparing photo features.

**DJMC 508 Punjabi Journalism**  
0+2  
Sem. I

Practical: Reading newspapers and clipping the stories. Writing agricultural, rural and development articles, features and news; collecting, writing, reading and editing Punjabi news; translation of news in Punjabi; communication skills and techniques in Punjabi; practice of writing various types of advertisements, invitations; analytical study of Punjabi editorials, letters to the editors of newspapers and magazines; study print lines of various newspapers, map supplements of different newspapers; conducting interviews; common grammatical problems; writing headlines and photo-captions in Punjabi. Preparing farm talks for radio and TV, compeering skills for agricultural programmes, evaluation of communication effectiveness of selected radio and TV programmes.

**DJMC 509 Functional English for Mass Communication**  
1+1  
Sem. I

Comprehension of selected passages; critical study of journalistic writing; various forms of journalistic writings; introduction, story board; style, structure and format of journalistic prose; prerequisites of writing a journalistic prose; important works of prose; choice of words: jargon, archaism, trite expressions, redundancy of expression, malapropism; clichés: idioms and phrases; figurative language; words causing confusion: metaphor, simile, homonyms, homophones, pair of words; principles of effective use of language for communication; grammatical problems: lack of agreement between subject and verb, faulty parallelism, dangling modifiers, illogical shifts in construction, problem of spelling; use of library for writing project reports; documentation.

Practical: Exercises in comprehension; grammar and usage; writing book review and popular articles.

**DJMC 510 Editing and Editorial Writing**  
1+1  
Sem. II

Editing: significance and principles; style book of newspapers and magazines. Newsroom organization: different departments and desks, editorial, supplements, circulation, advertising, printing etc; functions of news editor; chief sub-editor/sub-editors; editorial department; selection of news stories.

Practical: Subbing and editing; subbing and proof reading symbols; editing tele-printer copies/online editing of news; Desk Top Publishing; use of publishing softwares: PageMaker and Quark; publication of university monthly/fortnightly house journal; interview of two prominent personalities; newspaper reading and maintenance of press clippings.

**DJMC 599 Project Report**
B. ENGLISH

Undergraduate Courses

Eng. 91 English I 2+1 Sem. I
An anthology of modern prose and poetry for intensive study; a book of biographies for general reading.
Practical: Sequence of tenses; antonyms; synonyms; one-word substitution; formation of words; words used as different parts of speech; transformation of sentences: simple, compound and complex; interchange of voice, narration and degrees of comparison; letter writing for personal communication. Translation from English into vernacular. A special question for foreign students in lieu of translation.

Eng. 92 English II 2+1 Sem. II
An anthology of modern prose for intensive study; a book of biographies for general reading.
Practical: Use of articles, pronouns; conjunctions and prepositions; position and order of adverbs; tenses; paragraph writing; comprehension of unseen passages; punctuation; words often misspelt. Translation from vernacular into English. A special question in lieu of translation for foreign students.

Eng. 102 Comprehension and Communication Skills in English. 1+2 Sem. I, II
Practical: Practice in phonetic transcription. Listening to recorded conversation aimed at testing the listening comprehension of students. Listening to audio and video presentations on phonetic sounds and imitating them to comprehend the correct pronunciation of syllabili. Use of intonation and voice modulation in deliverance of speeches, presentations and short talks. Powerpoint presentation on a given topic related to agriculture. Facing interviews; face to face conversations; preparing flashcards for commentaries and public speaking; recording of telephonic conversation; role-playing; word association exercises and conducting group discussions. Reading comprehension passages using compare/contrast and cause effect method. Drafting precis, curriculum vitae, letters; job applications and diary entries.

Eng. 301 Communication Skills and Technical writing 1+2 Sem. I
Basic English sounds; phonetic transcription; syllabic division of words; word accent; connected speech; choice and arrangement of words; qualities of technical style; technical paragraph; technical report; collecting information; first draft; revision and editing; final draft; technical vocabulary; formal correspondence; note-making; use of dictionary, thesauruses and encyclopaedias.
Practical: Exercises in speaking words in isolation; connected speech; grammar and usage; words often confused; technical vocabulary; exercises in technical paragraphs, technical reports and articles; exercises in note-making; formal correspondence; conversation; group discussion; facing interview boards; Listening to at least two tapes, recorded conversation aimed at testing the listening comprehension of students. Presentation on a given topic related to agriculture. Evaluation of a presentation, face to face conversation, telephonic conversation. Conducting mock interviews and conversations.

Postgraduate Courses

PGS 501 Technical Writing, Communication Skills and Library and Information Services 1+2 Sem I, II
Theory: Technical Writing-Various forms of technical writing-theses, technical papers, reviews, electronic communication etc; qualities of technical writing; parts of research communications- title page, content page, authorship, preface, introduction, review of literature, materials and methods, experimental results, documentation; photographs and drawings with suitable captions; pagination; citations; writing of abstracts; précis; synopsis; editing and proof reading. Communication Skills-defining communication; types of communication- verbal and non-verbal; assertive communication; assertive
communication; using language for effective communication; techniques of dyadic communication- message pacing and message chunking, self disclosure, mirroring, expressing conversational intent; paraphrasing; vocabulary building- word roots, prefixes, Greek and Latin roots.

Practical: Editing and Proof reading technical articles; using language tools for effective writing; listening to audio-video conversations aimed at testing the comprehension of the students; oral presentations on a given topic related to agriculture; evaluation of body language and communication skills based on group discussions and interviews; role plays and pronunciation exercises; using eye contact and visual clues for effective listening skills; word stress application and voice modulation; soft skills; rhetoric skills; self-assessment exercises. Introduction to Library and its services; Five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information-primary, secondary and tertiary; current awareness and SDI services; tracing information from reference sources; library survey; preparation of bibliography; use of Online Public Access Catalogue; use of CD-ROM databases and other computerized library services, CeRA, J-Gate; use of Internet including search engines and its resources; e-resources and access methods.

Eng. 501 Advanced Comprehension and Composition

Comprehension of passages selected from journals, newspapers and books: style, structure and format of comprehension; prerequisites of writing a comprehension; epitomization: summaries, précis, book review, abstract and synopsis writing; diction; etymology: definitions, word meaning; denotation and connotation: definitions and meanings; concrete and abstract words: definitions and meanings; choice and arrangement of words: rules of proximity, avoiding a split infinitive, use of connectives, avoiding ambiguity, position of adverbs; clichés-idioms and phrases; figurative language; words causing confusion: metaphor, simile, homonyms, homophones, pair of words; principles of effective writing; basic units of writing; kinds of sentence: classification by function and structure; important grammatical problems: objectivity, conciseness, concreteness, directness; forms of writing: scientific and technical writing, reports, articles, papers, manuals, dissertations and theses, correspondence; styles of writing: cultural, creative, journalistic writings.

Practical: Exercises in Comprehension, epitomization: summaries, précis, abstract and synopsis writing; writing of reports and book reviews, usage and composition; writing a creative piece on a given subject; writing of words causing confusion: metaphor, simile, homonyms and homophones; styles of writing: cultural, creative, journalistic writings. Listening to at least two tapes regarding British pronunciation techniques; recorded conversation aimed at testing the listening comprehension of students; group discussions on the current issues concerning society; planning for meetings, holding mock meetings; facing interviews by holding mock interviews; presentations by using PowerPoint and LCD projector; public speaking on any topic.

Eng. 502 Contemporary Prose

Critical study of selections from contemporary prose representing creative prose: style, structure and format of prose, prerequisites of writing a prose, use of figurative language, diction, choice of words and arrangement of words; Charles Lamb- Dream Children, Bachelor's Complaint; Francis Bacon: Essays. Cultural writings: style, structure and format of cultural prose, prerequisites of writing a cultural prose, glimpses of colonialism, post colonialism and Diaspora in cultural prose. Scientific prose: various forms of scientific writings: theses, technical papers, review, manuals etc. Various parts of thesis and research communications: title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion; diction, choice of words and arrangement of words. Journalistic writing with emphasis on Indo-Anglian Prose: various forms of journalistic writings: introduction, story board; style, structure and format of journalistic prose, prerequisites of writing a journalistic prose, important works of prose, especially journalistic, by western and Indian writers known for thought and style.

Practical: Writing reviews and popular articles. Listening to at least two tapes regarding British pronunciation techniques; recorded conversation aimed at testing the listening comprehension of students; group discussions on the current issues concerning society; planning for meetings, holding mock meetings; facing interviews by holding mock interviews; presentations by using PowerPoint and LCD projector; public speaking on any topic.
Eng. 503 Communication for Management and Business 1+1 Sem.I
Communication process; barriers to communication; effective communication; types of communication in organizations viz. downward, upward, horizontal, static vs. dynamic; business terms viz. E-mail, Fax, Internet Protocol; communication through clothes, color, space, symbol, body language and etiquettes; interpersonal communication; self-concept and communication; assertive communication. Types of business writing; writing of newsletters; preparation of reports; compiling of folders; fact sheets; press release. Business communication through memos; business letters; office notices; job applications; press release; advertisements; curriculum vitae; drafting minutes of a business meeting; public relations and mass communication (meaning and need for PR, seminars, methods of mass communication).
Practical: Listening to at least two tapes regarding British pronunciation techniques; recorded conversation aimed at testing the listening comprehension of students; group discussions on the current issues concerning society; planning for meetings, holding mock meetings; facing interviews by holding mock interviews; presentations by using PowerPoint and LCD projector; public speaking on any topic.

C. PUNJABI
Undergraduate Courses
Punjabi 91 Punjabi I 2+1 Sem. I
Folk Literature: definition, salient features and its types. An introduction of Punjabi Folk literature and its relevance in Punjabi Culture, Punjabi folk songs and their various types; definition and selected text reading of Suhag, Ghorian, Sthnian, Tappa, Bolian, Dhola and Mahia. Folk tales and its various types; definition and selected text reading of myths, fairy tales, moral stories, legends, romantic stories; translation from English to Punjabi; technical terminology related to different fields: agriculture and allied occupations, official/administrative, bank, railways, post and telegraph and insurance etc.
Practical: Letter to the editor; advertisement; definition, types and their relevance in daily life. Invitation: definition, types and major elements of an invitation. Paragraph writing; important features of paragraph writing and practice. Idioms and their usage.

Punjabi 92 Punjabi II 2+1 Sem.II

Pbi. 101 Basic Punjabi 0+2 (NC) Sem.I
(For undergraduate students who have not studied Punjabi upto Matric or 10 +2 level)
Gurmukhi script; sequence of letters in Punjabi alphabet and their pronunciation; similarities and dissimilarities of gurmukhi and devnagri script; why the script of Punjabi is called gurmukhi; linguistics: definition and its application in gurmukhi script; a brief note on various dialects of Punjabi e.g. Malwai, Majhi, Doabi, Puadhi; Dogri, Kangri etc. and dialects of west Punjab; matras; nasal sounds and their signs; word formation and pronunciation; standard spelling; correct incorrect; sentence structure, basic Punjabi grammar; idioms; proverbs; synonyms; antonyms, gender; number; one word substitution; pair of words; words having multiple meanings; agricultural terminology; paragraph; precise and letter writing; translation of simple passages from English to Punjabi; practice in spoken Punjabi, comprehension of a passage related to agriculture; practice in creative writing.
Pbi Cul 101 Punjabi Culture 2+0 (NC) Sem.I
(For ICAR nominees and Foreign Students)
Culture: definition; concepts and scope. Punjabi Culture: characteristics of Punjabi culture; Punjabi culture in the context of geography, history, language, literature, religion, art; folklore; fairs and festivals of Punjab as mirror of Punjabi culture; sports and games; customs; beliefs; rituals; legends and different occupations of rural Punjab; changing patterns of Punjabi culture through the ages; socio-economic and political changes in Punjab in the context of changing international scenario; technical developments in the field of agriculture leading to the Green Revolution in the Punjab and its impact on the culture of the State; impact of Post-Green Revolution developments on the culture of Punjab.

Postgraduate Courses

Pbi. 501 Punjabi Literature and Culture 3+0 Sem.I
Major movements in Punjabi Culture with special emphasis on gurmat, sufi, kessa and heroic poetry; revivalist and reformist trends; western influence on Punjabi Culture and Literature; impact of national liberation movement; progressive movement and experimental trends in Punjabi literature. Culture: concepts, scope; Punjabi culture: characteristics of Punjabi culture; Punjabi culture in the context of geography, history, language, literature, religion, art and architecture, folklore, drama and theatre, handicrafts, fairs and festivals, sports and games, customs, beliefs, values, rituals, myths and legends and religion; changing patterns of Punjabi culture through the ages; socio economic and political changes and technological developments since partition and their impact on contemporary Punjabi culture; Punjabi ethos.

Pbi. 502 Punjabi Journalism 2+1 Sem.II
Origin and development of Punjabi journalism; contribution of Christian missionaries; role of Singh Sabha, Chief Khalsa Diwan; Akali and religious movements, secular trends; contemporary trends; prominent Punjabi dailies, weeklies and monthlies; famous Punjabi journals.
Practical: Writing articles, features and news on socio-historical and political movement; eminent personalities and writers, editing Punjabi news; translation of news in Punjabi, common grammatical problems, writing headlines and photo captions in Punjabi analysis of editorials.

D. FOREIGN LANGUAGES

French 501 Proficiency in French 2+0 Sem. I, II
French alphabet and sound system (sounds of individual letters, diphthongs, rules of pronunciation etc.); articles (definite, indefinite, partitive, contracted) and present tense/present perfect tense of verbs of the three groups such as parler, finir, entendre etc.; conjunctions (mais comme si, meme si, cependant etc.); gender and number of nouns; conjugations (affirmative, negative, interrogative); prepositions (sur, sous, devant, derriere, dans, a etc.) adverbs, adjectives (common adjectives which are placed before or after nouns, possessive adjectives etc.) and pronouns (simple pronouns, personnel pronouns), cardinal numbers from 1 to 100; translation from French to English (of words, sentences and passages); accent (aigu, grave, circonflexe).
MATHEMATICS, STATISTICS AND PHYSICS

PROGRAMMES

M.Sc. Statistics, Physics
Ph.D. Statistics, Physics

COURSE REQUIREMENTS

M.Sc. (Statistics)

Fields of specialization Design of experiments, Sample surveys


Supporting courses PGS 501 and courses related to area of special interest and research problem.

Minor fields Mathematics, Economics, Business Management, Plant Breeding & Genetics or any other as approved by the Dean, Postgraduate Studies

Deficiency courses As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies

Ph.D. (Statistics)

Fields of specialization Design of experiments, Sample surveys.

Required courses Stat. 601 and Stat. 602

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

Minor fields Mathematics, Economics, Business Management, Plant Breeding & Genetics or any other as approved by the Dean, Postgraduate Studies

Deficiency courses As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies

M.Sc. (Physics)

Fields of specialization Physics Solid State Physics, Nuclear Physics, Agricultural Physics

Required courses Phys. 501, Phys. 502, Phys. 503, Phys. 504. Supporting courses Stat. 421 and other courses from subject matter fields (other than Minor) relating to area of special interest and research problem
DESCRIPTION OF COURSE CONTENTS

A) MATHEMATICS

Undergraduate Courses

Math. 104 Basic Mathematics-I
Complex numbers Geometric series. Logarithms. Binomial theorem for positive index. Trigonometric identities and allied angles, graphs of trigonometric functions, addition and subtraction formulae, sum and product formulae, multiple and sub-multiple angles.
Practical: Tutorials on: complex numbers, geometric series, logarithms, binomial theorem and trigonometric identities.

Math. 106 Introductory Mathematics

Math. 107 Fundamental Mathematics
Math. 108 Basic Mathematics-II 1+1 Sem .II

Math. 203 Biomathematics 2+1 Sem. I
Mean value theorems (without proofs) and expansions. Partial differentiation, Jacobians, maxima and minima for more than one variable. Simple problems of eigen values and eigen vectors of a matrix. Reduction formulae. Properties of definite integrals and their applications. Ordinary differential equations of first order and first degree and their applications for the determination of volume of blood and drug distribution. Epidemic models. Solution of a system of two first order simultaneous linear differential equations and its application to prey-predator models. Solution of linear differential equations of higher order and its application to simple biological problems. Introduction to numerical methods for solving algebraic and transcendental equations. General introduction to computers, organization of hardware, input devices, memory, control unit, arithmetic logic unit, output devices. software: system software, application software; interpreter, compiler, data processing, application of internet. Application of computers in biotechnology. Sequence analysis.
Practical: Tutorials on: expansions, partial differentiation, definite integrals, differential equations and their applications to biological problems, numerical methods and application of computers in biotechnology. Sequence analysis.

Math. 211 Engineering Mathematics-I 2+1 Sem .I
Differential calculus: Taylor's and Maclaurin's expansions, indeterminate forms, curvature, asymptotes, tracing of curves, function of two or more independent variables, partial differentiation, homogeneous functions and Euler's theorem, composite functions, total derivatives, derivative of an implicit function, change of variables, Jacobians, error evaluation, maxima and minima. Integral calculus: reduction formulae, rectification of standard curves, volumes and surfaces of revolution of curves, double and triple integrals, change of order of integration, Gamma and Beta functions, application of double and triple integrals to find area and volume. Vector calculus: differentiation of vectors, scalar and vector point functions, vector differential operator Del, gradient of a scalar point function, divergence and curl of a vector point function and their physical interpretations, identities involving Del, second order differential operator, line, surface and volume integrals, Stoke's, divergence and Green's theorems (without proofs).
Practical: Tutorials on: Taylor's and Maclaurin's expansion, indeterminate forms, curvature, tracing of curves, partial differentiation, Jacobians, maxima and minima, error evaluation, reduction formulae, rectification of standard curves, volume and surface of revolution, multiple integrals, Beta and Gamma functions, differentiation of vectors, gradient, divergence and curl of a vector point function, line, surface and volume integrals, Stoke's, divergence and Green's theorems.

Math. 212 Engineering Mathematics-II 2+1 Sem.II
Matrices: elementary transformations, rank of a matrix, reduction to normal form, Gauss- Jordon method to find inverse of a matrix, consistency and solution of linear equations, eigen values and eigen vectors, Cayley-Hamilton theorem, linear transformation, orthogonal transformations, diagonalisation of matrices, bilinear and quadratic forms. Ordinary differential equations: Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's equation, differential equations of higher orders, methods of finding complementary functions and particular integrals, method of variation of parameters, Cauchy's and Legendre's linear equations, simultaneous linear differential equations with constant coefficients, application of differential equations to L-C-R circuits, series solution techniques, Bessel's and Legendre's differential equations. Infinite series and its convergence. Periodic functions. Fourier series, Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series and harmonic analysis.
Practical: Tutorials on: rank of a matrix, reduction to normal form, consistency and solution of linear equations, eigen values and eigen vectors, Cayley-Hamilton theorem, diagonalisation of matrices, bilinear
and quadratic forms, solution of ordinary differential equations of first and higher orders, application of
differential equations, series solutions of differential equations, Bessel's and Legendre's differential equations,
convergence of infinite series, Fourier series and harmonic analysis.

Math. 311 Engineering Mathematics-III 2+1 Sem.I
Numerical analysis: finite differences, various difference operators and their relationships, interpolation
with equal and unequal intervals, numerical differentiation, maxima and minima of a tabulated function,
numerical integration; numerical integration by Trapezoidal, Simpson's and Weddle's rules, difference
equations, solution of linear difference equations, numerical solution of ordinary differential equations by
Picard's, Taylor's series, Euler's, modified Euler's and Runge-Kutta methods. Laplace transforms, properties of Laplace transforms, inverse Laplace transforms, application of Laplace transforms to solve
ordinary and simultaneous differential equations, Laplace transforms of unit step function, unit impulse
function, periodic function. Functions of a Complex variable: limit, continuity and derivative of complex
functions, analytic function, Cauchy-Reimann equations, conjugate functions, Harmonic functions. Partial
differential equations: formation of partial differential equations, Lagrange's linear equation, Higher order
linear partial differential equations with constant coefficients, solution of non-linear partial differential
equations, Charpit's method. Application of partial differential equations (one dimensional wave and
heat flow equations, two dimensional steady state heat flow equation (Laplace equation).

Practical: Tutorials on: interpolation with equal and unequal intervals, numerical differentiation,
numerical integration, maxima and minima, solutions of difference equations, numerical solutions of
ordinary differential equations of first order and first degree, Laplace transformation, inverse Laplace
transformations and their application to ordinary differential equations, analytical functions, C-R equations,
harmonic functions, solutions of linear and non-linear partial differential equations and application of partial
differential equations.

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

Math. 421 Fundamentals of Calculus 2+0 Sem.II
Partial differentiation, maxima and minima of two or more variables, Lagrange's multipliers, implicit
Function, Jacobian determinant and applications in error analysis. Integration, reduction formulae. Applications
to find areas and volumes. Double integrals. Ordinary differential equations, complete solution of linear
differential equations and particular solution by variation of parameters. Simultaneous linear differential
equations. Application to simple economic models.

Math. 422 Matrix Algebra 2+0 Sem. I
Determinants and matrices, special types of matrices, algebraic operations, partitioning of matrices, rank
of a matrix, rank of a product of matrices, inverse of a matrix by Gauss elimination, Jacobian determinant and applications in error analysis. Integration, reduction formulae. Applications
to find areas and volumes. Double integrals. Ordinary differential equations, complete solution of linear
differential equations and particular solution by variation of parameters. Simultaneous linear differential
equations. Application to simple economic models.

Math. 423 Elementary Calculus for Business Management 2+0 Sem.I
Partial differentiation. Analytical optimization techniques. Integration and simple applications to
management problems. Ordinary differential equations and their applications to management problems.

Postgraduate courses

Math.501/Stat.513 Optimization Techniques 2+1 Sem.II
Balanced and unbalanced transportation problems. Assignment problems. Two person zero sum game.
Kuhn-Tucker's optimality conditions. Introduction to non-linear programming. Quadratic programming: Frank-
method, branch and bound method.

Math. 502 Computational Methods and Programming 1+1 Sem. I
Fortran-77, statement structure, algorithm structure, input/output statements, string and array manipulation. Numerical computation: numerical solution of algebraic and polynomial equations, system of linear algebraic equations, interpolation, numerical differentiation and integration, least square analysis and regression analysis.
Practical: Tutorials on: flow charting and program writing in FORTRAN-77 for the numerical methods listed in the contents.

Math. 503 Abstract Algebra and Linear Transformation 3+0 Sem.I
Group, sub-group, group of symmetries, permutation, cyclic groups and quotient groups. Lagrange's theorem. Homomorphism and isomorphism. Ring, field, integral domain and its field of quotients, subring and ideal, polynomial ring, extension and field of construction of a finite field. Vector space, subspace, basis, orthogonal basis, direct sum, quotient space, linear transformation, rank and nullity. Algebra of linear transformation, relation between linear transformation and matrix, effect of change of basis, singularity and inverse, rank of a matrix and solution of linear equations. Eigen values and eigen vectors, Cayley-Hamilton theorem, equivalence, similarity and congruence, self-adjoint, unitary and normal matrices and transformations, bilinear transformation and quadratic forms.

Math. 504 Mathematical Analysis and Topology 2+0 Sem.II

Math. 505 Functions of Complex Variables 2+0 Sem.II

Math. 506 Numerical Analysis 2+1 Sem. I
Math. 507 Numerical Methods for Ordinary and Partial Differential Equations 2+1 Sem. II

Math. 508 Differential Equations and Special Functions 2+1 Sem.I

Math. 509 Mathematical Physics 2+0 Sem.I

Math. 510 Functional Analysis 2+0 Sem.I

Math. 511 Theory of Calculus of Variations and Operational Calculus 2+1 Sem. II

B) STATISTICS
Undergraduate Courses
Stat. 102 Basic Statistics 1+1 Sem. II
Correction for continuity. Correlation. Computation of correlation coefficient ‘r’ and its testing. Linear regression of Y on X and X on Y. Inter-relation between ‘r’ and the regression coefficients. Layout and analysis of Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design (LSD).

Practical: Construction of frequency distribution tables and frequency curves. Computation of arithmetic mean, median, mode, standard deviation, variance and coefficient of variation for ungrouped and grouped data. SND test for means. Student's t-test. F-test and Chi-square test. Correlation coefficient ‘r’ and its testing. Fitting of regression equations. Analysis of CRD, RBD and LSD.

Stat. 201 Elementary Statistics 2+0 Sem.II

Stat. 202 Biostatistics 2+1 Sem.I


Stat. 203 Engineering Statistics 2+0 Sem.II

Stat. 204 Principles of Statistics 2+0 Sem.II
Review of central tendency and dispersion. Karl Pearson's correlation coefficient. Simple linear regression. Elementary ideas about sampling. Test of significance: null hypothesis and alternative hypothesis, two types of errors, level of significance, critical region and degrees of freedom. Standard normal deviate test for single mean and difference between two means. Student's t-test for single mean and difference between two means. Paired t-test. Chi-square test for goodness of fit and independence of attributes in 2x2 contingency table. Yate's correction. Analysis of variance of one-way classification (with equal and unequal number of observations). Two-way classification with one observation per cell (no mathematical derivations).

Undergraduate Elective/M.Sc. Supporting/Minor Courses:
Stat. 421 Statistical Methods for Research Workers 2+1 Sem.I & II

**Stat. 422 Experimental Designs for Research Workers**

2+1 Sem. II


Postgraduate Courses:

**Stat. 501 Probability Theory**

2+0 Sem. I


**Stat. 502 Statistical Methods**

2+1 Sem.I


**Stat. 503 Statistical Inference**

3+1 Sem.I


**Stat. 504 Theory of Multivariate Techniques**

2+1 Sem.I


**Stat. 505 Theory of Designs and Analysis of Experiments** 3+1 Sem.II


**Stat. 506 Theory of Sampling Techniques** 3+1 Sem. I


**Stat. 507 Regression Analysis** 1+1 Sem.I


Stat. 508 Statistical Computing 1+1 Sem. II

Stat. 509 Time Series Analysis 1+1 Sem. II

Stat. 510 Actuarial Statistics 2+0 Sem. I

Stat. 511/Econ.503 Econometrics 2+1 Sem. II

Stat. 512 Statistical Quality Control and Data Mining 2+0 Sem.II

Stat.513 /Math.501 Optimization Techniques 2+1 Sem.II

Stat. 514 Statistical Ecology 2+0 Sem. I

Computer and computer language. Discussion of algorithms for development of computer programmes: linear, multiple regression, correlation coefficient, completely randomized design, randomized block design, latin square design and analysis of variance of two way classification with unequal cell frequency. Application of EXCEL for various statistical methods.

Stat. 521 Multivariate Statistical Methods 2+1 Sem. II

Stat. 522 Designs of Surveys 2+1 Sem. II

Stat. 523 Applied Regression Analysis 2+1 Sem. II


Stat. 524 Economic Statistics 2+1 Sem.II


Stat. 525 Data Analysis Using Statistical Packages 1+1 Sem.II


Stat. 526 Non-parametric Statistics 2+1 Sem.II
Parametric versus non-parametric tests. Scales of measurements. Current tests of hypotheses when distribution is not specified. Rank and permutation tests of one, two and k samples. Co-efficient of concordance. Application in biological and sociological work.


Stat.527/ABM. 512/Mgt. 512/Econ.508 Quantitative and Optimization Techniques for Economics and Management 2+1 Sem. II


Stat. 601 Advanced Statistical Inference 3+0 Sem.I

Stat. 602 Advanced Statistical Computing 2+1 Sem.I


Stat. 603 Advanced Statistical Methods 2+0 Sem.I

Stat. 604 Advanced Design of Experiments 2+0 Sem.II
General properties and analysis of block designs. Balancing criteria. M-associate PBIB designs: their

Stat. 605 Advanced Sampling Techniques

Stat. 606 Advanced Time Series Analysis

Stat. 591 Seminar
Stat. 600 Project Research
Stat. 700 Ph.D. Research
PHYSICS

Undergraduate Courses

Phys. 91 Physics-I 3+1 Sem. II

Phys. 92 Physics-II 3+1 Sem. I

Phys. 101 Elementary Physics 1+1 Sem. II

Phys. 202 Fundamentals of Biophysics 2+1 Sem. II

Phys. 203 Engineering Physics 2+1 Sem. I
### POSTGRADUATE COURSES

**Phys. 421 Modern Physics**  
2+1  Sem. I  

**Phys. 422 Atomic Spectra**  
2+0  Sem. II  

**Phys. 501 Classical and Statistical Mechanics**  
3+0  Sem. I  

**Phys. 502 Physical Electronics**  
2+1  Sem. I  

**Phys. 503 Quantum Mechanics**  
3+0  Sem. II  
Phys. 504 Electrodynamics and Plasma Physics 3+0 Sem.I

Phys. 505 Solid State Physics 3+1 Sem.II


Phys. 506 Nuclear Physics 3+1 Sem.II


Phys. 507 Nuclear Techniques in Agriculture 2+1 Sem.II


Phys. 508 Material Science 2+1 Sem.I

**Phys. 509 Radiation Physics** 2+1 Sem.II

**Phys. 510 Solid State Devices** 2+1 Sem.I

**Phys. 511 Agricultural Physics** 2+0 Sem.II

**Phys. 512 Principles of Remote Sensing and its Applications in Agriculture** 2+0 Sem.I

**Phys. 513 Principles of Physical Techniques in Agriculture** 2+1 Sem.I
Phys. 601 Current Topics in Physics 3+0 Sem.I

Phys. 602 Advanced Topics in Quantum Mechanics 3+0 Sem. I

Phys. 603 Advanced Topics in Solid State Physics I 3+0 Sem. II

Phys. 604 Advanced Topics in Nuclear Physics I 3+0 Sem. II

Phys. 605 Advanced Topics in Solid State Physics II 3+0 Sem I

Phys. 606 Advanced Topics in Nuclear Physics II 3+0 Sem II

Phys. 591 Seminar
Phys. 600 Master's Research
Phys. 700 Ph.D. Research
MICROBIOLOGY

PROGRAMMES
M.Sc.
Ph.D.
Five Year Integrated M.Sc. (Hons.)

COURSE REQUIREMENTS

M.Sc.
Fields of specialization
Industrial Microbiology, Microbial Genetics, Soil Microbiology, Food Microbiology.

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
Biochemistry, Plant Breeding and Genetics, Soils, Plant Pathology, Food Science and Technology, Biotechnology or any other as approved by the Dean, Postgraduate Studies.

Deficiency courses
As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph.D.
Fields of specialization
Industrial Microbiology, Microbial Genetics, Soil Microbiology, Food Microbiology.

Required Courses
Micro. 601, Micro. 602.

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

Minor fields
Biochemistry, Plant Breeding and Genetics, Soils, Plant Pathology, Food Science and Technology, Biotechnology or any other as approved by the Dean, Postgraduate Studies.

Deficiency courses
As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Five Year Integrated M.Sc. (Hons.)

Fields of specialization
Industrial Microbiology, Microbial Genetics, Soil Microbiology, Food Microbiology.

Required Courses
All courses listed for Semester I-VI (P-499) and Micro. 501, Micro. 502, Micro. 503, Micro. 504, Micro. 505.

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

Minor fields
Biochemistry, Plant Breeding and Genetics, Soils, Plant Pathology, Food Science and Technology, Biotechnology or any other as approved by the Dean, Postgraduate studies.

Deficiency courses
As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Micro. 101 Elementary Microbiology 2+1 Sem I

Micro. 202 Introduction to Microbiology 3+0 Sem II

Micro. 203 Basic Bacteriology 2+0 Sem I
Bacterial taxonomy, cell structure and organization of bacterial cell, cell wall, periplasm, outer membranes in Gram-ve bacteria, cell surface extensions, motility, role of pili in adhesion, motility, DNA exchange, capsule, spore, heterocysts, Archaebacteria. Unique structures in Eukaryotes, mitochondria and plastids, economic importance of bacteria.

Micro. 204 Basic Mycology and Phycology 3+0 Sem I

Micro. 205 Basic Virology 2+0 Sem II
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Semester</th>
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<tbody>
<tr>
<td>Micro. 301</td>
<td>Introductory Microbiology</td>
<td>2+1</td>
<td>II</td>
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<tr>
<td>Micro. 303</td>
<td>Biotech. 304 Introduction to Industrial Biotechnology</td>
<td>2+1</td>
<td>II</td>
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<tr>
<td>Micro. 304</td>
<td>Introduction to Applied Microbiology</td>
<td>3+0</td>
<td>I</td>
</tr>
<tr>
<td>Micro. 305</td>
<td>Basic Experiments in Microbiology</td>
<td>0+3</td>
<td>II</td>
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<tr>
<td>Micro. 306</td>
<td>Fundamentals of Food and Dairy Microbiology</td>
<td>3+1</td>
<td>I</td>
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<tr>
<td>Micro. 307</td>
<td>Bacterial Genetics</td>
<td>3+0</td>
<td>I</td>
</tr>
<tr>
<td>Micro. 401</td>
<td>Practicals in Microbiology</td>
<td>0+2</td>
<td>II</td>
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**Micro. 301 Introductory Microbiology**


**Micro. 303/Biotech. 304 Introduction to Industrial Biotechnology**

Microbial products; Acids, organic solvents, vitamins, enzymes and biodegradable plastics. Microbial technology; substrates. Upstream and downstream processing, Biotransformation, Fermentors, BOD and COD treatments and disposal of effluents. Hybridization technology and production of vaccines, Production of plant secondary metabolites through cell and hairy root cultures. Concepts of industrial fermentation-batch and continuous, production of biopharmaceuticals. Immobilization techniques.


**Micro. 304 Introduction to Applied Microbiology**

Important disciplines of applied microbiology. Importance and applications of microorganisms in food, dairy and industry. Food spoilage and food borne diseases. Food preservation and sanitation. Microbiology of milk and milk products. Industrial fermentation of alcohol, alcoholic beverages and enzymes. Brief account of agriculturally important microorganisms - biofertilizers, biopesticides and bioremediation.

**Micro. 305 Basic Experiments in Microbiology**

Microscopy. Examination of different types of bacteria, fungi and other microorganisms, motility. Media preparation, isolation, cultivation and purification of microorganisms from air, soil and water. Principle and working - autoclave, laminar flow bench, hot air oven and other commonly used laboratory equipments. Measure of bacterial cell size, DMC using haemocytometer. Sterilization techniques.

**Micro. 306 Fundamentals of Food and Dairy Microbiology**

Introduction and importance of food and dairy microbiology. Food spoilage. Food preservation by physical and chemical means. Microbiology of cereals, meat, poultry, egg, fruits and vegetables, salt, sugar. Fermented foods-bread, malt beverages. Role of microorganisms in fermented milk products - butter and cheese, etc. Microbial enzymes in food processing. Pathogenic bacteria in milk and milk products and processed foods. Food poisoning and its control.


**Micro. 307 Bacterial Genetics**

Bacteria as tool for genetic studies, nature of genetic material, DNA structure, function, replication and synthesis. DNA damage and repair. RNA - types and functions. Mutations and their chemical basis, mutagenesis, spontaneous and induced mutations, reversion and suppression of mutants. Bacterial recombination- transformation, transduction and conjugation. Bacterial plasmids, fertility factors, resistance factors, transposable elements and insertion sequences. Role of genetic engineering in improving bacterial strains.

**Micro. 401 Practicals in Microbiology**


Micro. 421 Fundamentals of Microbiology 2+1 Sem. II

Micro. 422 Microbial Genetics 2+1 Sem. II

Micro. 423 Microbial Metabolism 2+0 Sem. II
Overview of pathways of intermediary metabolism (Importance in energy generation for the cell, role of enzymes). Different types of fermentations found in microorganisms (Homofermentation and Heterofermentation). Metabolic pathways of carbohydrate metabolism (Embden Meyerhof pathway, tricarboxylic acid pathway, Entner Duodrof pathway etc. Brief account of autotrophic (photoheterotrophs and chemoheterotrophs), heterotrophic (photoheterotrophs, chemoheterotrophs and organotrophs) and photoautotrophic (purple bacteria, green bacteria and cyano bacteria) metabolism. Energy generation and its use in biosynthesis of macromolecules (carbohydrates, lipids, amino acids and nucleic acid). Brief discussion on the regulation of metabolism (transcriptional, post transcriptional, translational and post translational). Nitrogen fixation and assimilation (structure and physiology of nodule in symbiosis).

Micro. 424 Fermentation and Industrial Microbiology 2+1 Sem. II

Micro. 425 Fundamentals of Mushroom Cultivation 1+1 Sem. I
Taxonomic classification, nomenclature and important feature of edible fungi, distinction between edible and poisonous taxa and characters of poisonous varieties of mushrooms. Nutritional, physiological and ecological parameters for growing edible variety of mushroom. Cultivation technology of edible varieties of
mushrooms including substrate pretreatment, its preparation, composting methodologies, spawn types and preparation of spawn, growing methodologies of different varieties of mushrooms for small, medium and commercial scale and crop management practices.

Practical: Methodology of substrate pretreatment, preparation and composting of substrate, Tissue culture, Master culture and spawn preparation techniques, cultivation methodology for commonly cultivated varieties of mushrooms and post harvest shelf life of these mushrooms.

**Micro. 426 Fundamentals of Soil Microbiology**

2+1 Sem. II


**Micro. 427 Fundamentals of Environmental Microbiology**

2+1 Sem. II


**Micro. 428 Fundamentals of Clinical Microbiology**

2+1 Sem. II

Host parasite relationship of infectious diseases, determinants of infectious diseases, attributes of pathogens and offending host-physical, chemical barriers and biological barriers, specific and non specific immune defense mechanisms of host, autoimmune diseases and allergic reactions. Introduction to pathogenic microbiology, epidemiology of infectious diseases, infectious disease cycle, transmission of infectious agents, surveillance, recognition, study and control of epidemics and nosocomial infection. Viral diseases, Characteristics of causal agents and disease control of selected diseases such as influenza, measles, yellow fever, rabies, poliomyelitis and AIDS. Microbial diseases of humans caused by Chlamydiae, rickettsiae, Gram positive and Gram negative organisms, human mycotic and parasitic protozoan infections.


**Micro. 433 Fundamentals of Food Microbiology**

2+1 Sem. I

Introduction and historical development of food microbiology. Food spoilage - sources and prevention by physical and chemical means. Microbiology of food - cereals, meat, poultry, egg, fruits, vegetables, milk, milk products, salt, sugar, etc. Role of microorganisms in fermented foods - bread, malt beverages, wine, vinegar, butter and cheese etc. Microbial enzymes in food processing. Waste water from food industries. Quality control of processed food. Pathogenic bacteria in milk and milk products. Food poisoning and its control.

Practical: Microbiological examination of various foods - fruits, vegetables, eggs, meat, milk and milk products. Starter culture - preparation, evaluation and applications. Microbiological analysis of water.
Postgraduate Courses

Micro. 501 Principles of Microbiology 3+1 Sem. I


Micro. 502 Microbial Physiology and Metabolism 3+1 Sem. II


Micro. 503 Microbial Genetics 3+1 Sem. I

Practical: Genetic variability, fluctuation test and replica plating. Induced mutagenesis. Plasmid curing, purification of plasmid DNA, electroporation/conjugation. Agarose gel electrophoresis, DNA amplification by PCR.
Micro. 504/Biotech. 507 Industrial Microbiology 2+1 Sem II


Practicals: 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.

Micro. 505 Laboratory Techniques in Microbiology 0+2 Sem I


Micro. 506 Food and Dairy Microbiology 2+1 Sem I

Introduction and scope; Food Microbiology - A many faceted science; Interrelationship of food microbiology with other sciences; Perspectives on food safety and Food Biotechnology. Factors of special significance in Food Microbiology - Principles influencing microbial growth in foods; Spores and their significance; Indicator organisms and Microbiological criteria; Microbial spoilage of foods- meat, milk, fruits, vegetables and their products; Food poisoning and food-borne pathogenic bacteria. Enzymes from microorganisms. Food fermentation; Fermented dairy, vegetable, meat products; Preservatives and preservation methods - physical methods, chemical preservatives and natural antimicrobial compounds. Bacteriocins and their applications; Biologically based preservation systems and probiotic bacteria. Symbiotic foods. Advanced techniques in detecting food-borne pathogens and toxins. Predictive Microbiology. Hurdle technology and Hazard Analysis and Critical Control Point systems in controlling microbiological hazards in foods. Practical: Statutory, recommended and supplementary tests for microbiological analysis of various foods: Baby foods, canned foods, milk and dairy products, eggs, meat, vegetables, fruits, cereals, surfaces, containers and water.

Micro. 507 Soil Microbiology 2+1 Sem II

Micro. 508 Clinical Microbiology 2+1 Sem I
Practical: Handling of laboratory animals, blood sampling, introduction of culture method biochemical identification and serological methods. Microbiological examination of sputum, nasal discharge, urine, stool, wounds and pus, etc. Serological diagnosis and typing of pathogenic bacteria. Gel precipitation test for bacterial toxins.

Micro. 509 Biofertilizer Technology 2+1 Sem I

Micro. 510 Biology and Cultivation of Edible Fungi 2+1 Sem II
Practical: Micro/macroscopic characteristics of important genera. Preparation and maintenance of spore and tissue cultures and spawn making. Compost preparation by long and short method and cultivation of important genera (Agaricus, Calocybe indica, Pleurotus, Volvariella, Auricularia and Lentinus edodes). Production, extraction and estimation of extracellular enzymes. Isolation of single spore isolates (SSI's) and in vivo somatic hybridization for mushroom strain improvement. Visit to a commercial mushroom growing unit.

Micro. 601 Current Topics in Microbiology 3+0 Sem II
Micro. 602 Advances in Microbial Physiology  3+0  Sem I

Micro. 603 Regulation of Microbial Biosynthesis  2+0  Sem II

Micro. 604 Advances in Soil Microbiology  3+0  Sem I

Micro. 605/Biotech. 605 Advances in Microbial Genetics and Biotechnology  2+0  Sem II

Micro. 606 Advances in Fermentation  3+0  Sem I

Micro. 591 Seminar
Micro. 600 Master's Research
Micro. 700 Ph.D. Research
ZOLOGICAL PROGRAMMES

M.Sc.

Ph.D.

Five Year Integrated M.Sc. (Hons.)

COURSE REQUIREMENTS

M.Sc.

Fields of specialization
Animal Physiology, Biosystematics and Biodiversity, Fisheries, Fresh Water Ecology, Parasitology, Vertebrate Pest Management.

Required courses
Zoo.501, Zoo.502, Zoo.503, Zoo.504, Zoo.505.

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

Minor fields
Biochemistry, Biotechnology, Botany, Entomology, Nematology, Food Science and Technology or any other as approved by the Dean, Postgraduate Studies.

Deficiency courses
As recommended by the Student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Ph.D.

Fields of specialization
Animal Physiology, Biosystematics and Biodiversity, Fisheries, Fresh Water Ecology, Parasitology, Vertebrate Pest Management.

Required courses
Zoo.601, Zoo.602.

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

Minor fields
Biochemistry, Biotechnology, Botany, Entomology, Nematology, Food Science and Technology or any other as approved by the Dean, Postgraduate Studies.

Deficiency courses
As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies.

Five Year Integrated M.Sc. (Hons.)

Fields of specialization
Animal Physiology, Biosystematics and Biodiversity, Fisheries, Fresh Water Ecology, Parasitology, Vertebrate Pest Management.

Required courses
All courses listed for Semester I-VI (P-502) and Zoo.501, Zoo.502, Zoo.503, Zoo.504, Zoo.505.

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

Minor fields
Biochemistry, Biotechnology, Botany, Entomology, Nematology, Food Science and Technology or any other field as approved by the Dean, Postgraduate Studies.

Deficiency courses
As recommended by the student's Advisory Committee and approved by the Dean, Postgraduate Studies.
DESCRIPTION OF COURSE CONTENTS

Undergraduate Courses

Zoo.91 Zoology I 3+1 Sem. I & II


Zoo.92 Zoology II 3+1 Sem. II


Zoo.93 Human Biology 3+1 Sem. II


Bio.101 Introduction to Biology 3+0 Sem. I
Zoo.102 Introductory Zoology  
2+1 Sem. I  

Zoo.103 Basic Zoology  
1+1 Sem. I & II  

Zoo.201 Introduction to Animal Biodiversity  
3+0 Sem. I  

Zoo.203 Introduction to Cell Biology and Immunology  
3+0 Sem. II  

Zoo.204 Introduction to Developmental Biology  
2+0 Sem. I  

Zoo.205 Human Physiology  
3+0 Sem. I  
functions and menstrual cycle. Nervous system - elementary study of anatomy and functions. Endocrine system - important ductless glands of the body and their functions. Sensory organs - anatomy and functions.

**Zoo.303 Fundamentals of Animal Biotechnology and Immunology 3+1 Sem. II**


**Zoo.304 Fundamentals of Animal Physiology 3+0 Sem. I**

Compound tissues and types of glands. Heterotrophic forms of nutrition, transport and mixing of food in the alimentary canal, secretory functions of digestive tract, digestion, absorption and malfunctions of GIT. Pulmonary ventilation, physiological principle of gaseous exchange, transport of oxygen and CO2 in the blood and regulation of respiration. Circulating body fluids and blood haemostasis. Heart as a pump, origin and propagation of heart beat, pulse, blood pressure, cardiac cycle and ECG. Functional anatomy of kidney, formation of urine, control of extracellular fluid, osmolality and counter-current mechanism, role of ADH and aldosterone. Physiology of human male and female reproduction. An over-view of other endocrine organs, their hormones and disorders. Functioning of excitable tissues, membrane potential, action potential and its propagation, synaptic and junctional transmission, ultrastructure of the skeletal muscle fibre and molecular mechanism of muscle contraction. Physiology of sense organs and receptors.

**Zoo.305 Fundamentals of Animal Ecology 2+0 Sem. II**


**Zoo.306 Basic Experiments in Zoology 0+3 Sem. I**


**Zoo.307 Systematics and Evolution of Animals 2+1 Sem. I**


**Zoo.308 Applied Zoology 3+1 Sem. II**

Useful animals and their products. Outlines of apiculture, sericulture, lac culture, edible and pearl oyster culture, pisciculture/aquaculture, poultry farming, dairy farming etc. Important human and veterinary

Practical: Study/survey of economically important animals. Study of protozoan, helminth parasites and arthropod vectors associated with human diseases. Study of vertebrate pests of agricultural crops and their control.

**Zoo.309 Zootechniques**  
1+1 Sem. II
Collection, maintenance, rearing, upkeep of animals in captivity, preservation (dry and wet techniques), classification, labeling etc. Ethical issues related to animal health and their use for zoological studies. Collection of tissues and fluids from animals. Routes of administration of test chemicals to animals. Preparation of reagents, fixatives, stains and tissue processing for histological preparations. Details of microtomy. Basic and selective staining methods. Frozen cryocut sections and principles of histo-chemistry. Principles of microscopy and its upkeep. Tissue processing for biochemical estimations.

Practical: Collection of small and large animals. Preservation of specimens for museum. Demonstration of injection routes and collection of fluids in albino rat. Sacrificing the animal and fixation of material and its processing for histological studies of selected organs of rat. Section cutting, stretching, staining and mounting of sections and their microscopic study.

**Zoo.310 Fundamentals of Animal Behaviour**  
2+1 Sem. I

Practical: Study of chemotaxis, feeding preferences and behaviour using animal maze.

**Zoo.311 Fundamentals of Applied Human Physiology**  
3+0 Sem. I

**Zoo.401 Form, Structure and Function of Invertebrates**  
3+1 Sem. II
General characteristics and outline of classification of different animal groups upto classes. Interrelationships amongst the major and minor invertebrate phyla. Functional anatomy and physiology of locomotion, digestion, respiration, circulation, excretion, neural and endocrine regulation, reproduction, sense organs and receptors of invertebrates. Larval forms and their evolutionary significance.

Practical: General survey of invertebrate forms. Study of histological preparations of organs representing different systems. Dissection of earthworm, cockroach and pila to demonstrate various systems. Experiments to demonstrate the response of some invertebrates to photic, mechanical, thermal, chemical and electrical stimuli.

**Zoo.402 Form, Structure and Function of Vertebrates**  
2+1 Sem. II
General characteristics and outline of classification of different animal groups upto orders. Functional anatomy and physiology of muscular, digestive, respiratory, sensory, circulatory, excretory, nervous, sensory, endocrine and reproductive systems of vertebrates.

Zoo.403 Cell Biology and Development in Animals
2+1 Sem. II

Zoo.404 Environmental Biology and Management
2+1 Sem. II

Zoo.405 Introduction to Fish and Fisheries
2+1 Sem. I
Practical: Collection, identification and classification of fishes of economic importance. Study of different types of nets and demonstration of fishing operation. Visit to field/fish market to analyse species composition, their size and sex ratio in a commercial catch. Assessment of fish stock.

Zoo.426 Applied Human Physiology
3+0 Sem. I
Postgraduate Courses

Zoo.501 Functional Anatomy and Physiology of Animals 3+1 Sem. I

Zoo.502 Cell and Developmental Biology 2+1 Sem. I

Zoo.503 Biosystematics and Biodiversity 1+1 Sem. II
Practical: Identification of important animals using conventional taxonomic keys and modern molecular methods. Sampling, extraction methods and identification of soil fauna.

Zoo.504 Animal Ecology and Bioresource Management 2+1 Sem. I

Zoo.505 Animal Behaviour and Wildlife Management 1+1 Sem. II


Zoo.506 Life History and Reproductive Strategies of Invertebrates 2+1 Sem. II

Practical: Study of asexual reproduction, gametogenesis, gametes and accessory reproductive organs. Demonstration of neurosecretory cells in invertebrates.

Zoo.507 Comparative Vertebrate Endocrinology and Reproduction 2+1 Sem. II


Zoo.508 Biology and Management of Birds 2+1 Sem. I

Zoo.509 Biology and Management of Mammalian Pests 2+1 Sem. II

Practical: Collection, identification and preservation of rodent pests, estimation of population by different methods, damage assessment methods in different crop fields, burrow structure and methods of control with special reference to agriculture.

Zoo.510 Parasitology 2+1 Sem. II
Introduction to parasitology. Morphology and life cycles of protozoan and helminth parasites of economic importance including Zoo and wild animals. Life cycle and control of arthropod and mollusc vectors. Diagnosis and control of parasitic infections. Immunity to parasites. In vitro culture of parasites. Conventional and
novel methods of control of protozoan and helminth parasites and vectors. Effect of climate change on proliferation and transmission of parasites.

Practical: Methods of collection, preservation and identification of protozoan and helminth parasites and arthropod vectors. Diagnosis of parasitic infections - conventional and immunological methods.

Zoo.511 Animal Biotechnology  
2+1  Sem. I

Zoo.512 Freshwater Ecology  
2+1  Sem. II

Zoo.513 Fish Production Technology  
2+1  Sem. I

Zoo.514 Fish Breeding, Genetics and Biotechnology  
2+1  Sem. I

Zoo.601 Advances in Cell and Developmental Biology  
2+0  Sem. II
Zoo.602 Advances in Animal Ecology, Behaviour and Bioresource Management  3+0  Sem. II

Zoo.603 Advances in Animal Biotechnology  2+0  Sem. II

Zoo.604 Advances in Biosystematics and Biodiversity  2+0  Sem. II

Zoo.605 Animal Genomics  2+0  Sem. I

Zoo.606 Advances in Reproductive Biology of Invertebrates  2+0  Sem. I

Zoo.607 Advances in Reproductive Biology of Vertebrates  2+0  Sem. I

Zoo.608 Molecular Endocrinology
2+0 Sem. I

Zoo.609 Advances in Biology and Management of Birds
2+0 Sem. I

Zoo.610 Advances in Mammalian Pest Management
2+0 Sem. I

Zoo.611 Advances in Parasitology
2+0 Sem. I

Zoo. 612 Applied Freshwater Ecology
2+0 Sem. I
of lake and reservoir restoration. Concept and scope of microbial consortia in protection of aquatic environment.

**Zoo.613 Advances in Fish Production Technology** 2+0 Sem. I

**Zoo.614 Advances in Fish Breeding, Genetics and Biotechnology** 2+0 Sem. I

**Zoo.591 Seminar**
**Zoo.600 Master's Research**
**Zoo.700 Ph.D. Research**
COURSE CURRICULUM FOR AWARD OF 3-YEAR B.Sc. DEGREE ON OPTING OUT OF 5-YEAR INTEGRATED M.Sc. (Hons.) PROGRAMME IN BIOCHEMISTRY (CORE COURSES)

DEFICIENCY COURSES

**BASIC SCIENCES AND HUMANITIES**

For PCM base:

Bio. 101 Introduction to Biology 3+0

For PCB base:

Math. 107 Fundamental Mathematics 2+1

**Regional Language**

For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level

Pbi. 101 Basic Punjabi 0+2 (NC)

**REQUIRED COURSES**

**BASIC SCIENCES AND HUMANITIES**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Math. 107/ Bio. 101</td>
<td>Fundamental Mathematics/ Introduction to Biology</td>
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<tr>
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<td>Introduction to Animal Biodiversity</td>
<td>3+0</td>
</tr>
<tr>
<td>Bot. 202</td>
<td>Plant Morphology</td>
<td>3+0</td>
</tr>
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<td>Econ. 203</td>
<td>Introduction to Economics and Project Evaluation</td>
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<tr>
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<td>Physical and Inorganic Chemistry</td>
<td>2+1</td>
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<tr>
<td>Eng. 301</td>
<td>Communication Skills and Technical Writing</td>
<td>1+2</td>
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<td>Basic Punjabi</td>
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<td>Micro. 202</td>
<td>Introduction to Microbiology</td>
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<td>Fundamentals of Biophysics</td>
<td>2+1</td>
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<td>Structure and Function of Biomolecules</td>
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<td>Introduction to Cell Biology and Immunology</td>
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<td>(Optional)</td>
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<td>Basic Virology</td>
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Biochem. 206 General Enzymology 2+0
Bot. 301 Fundamentals of Plant Physiology 3+0
Biochem. 302 Basic Experiments in Biochemistry 0+3
Micro. 305 Basic Experiments in Microbiology 0+3
Zoo. 305 Fundamentals of Animal Ecology 2+0
Mgt. 421 Introduction to Management and Marketing 2+0
Edu. Tour Educational Tour 0+2 (NC)
Biochem. 301 Introduction to Molecular Biochemistry 3+0
Bot. 302 Basic Experiments in Botany 0+3
Micro. 304 Introduction to Applied Microbiology 3+0
Zoo. 306 Basic Experiments in Zoology 0+3
Biochem. 423 Fundamentals of Molecular Biochemistry 2+0
Biochem. 425 Fundamentals of Plant Biochemistry 2+0
Biochem. 421 Fundamentals of Biochemistry 3+0
Biochem. 424 Experiments in Biochemistry 0+3
Biochem. 426 Fundamentals of Animal Biochemistry 3+0
Biochem. 429 Biochemical and Biophysical Techniques 3+0
Biochem. 430 Fundamentals of Enzymology 3+0
Biochem. 431 Fundamentals of Membrane Biochemistry 2+0

**AGRICULTURE**

1 Agron. 101/ Elements of Agronomy/ 2+1*
Ent. 201 Introductory Entomology 2+1*
PBG 102 Introductory Genetics 2+0*
Pl. Path. 201 Diseases of Field Crops and their Management 2+1*
2 Biotech. 307 Introduction to Bioinformatics 2+1
3 Biotech. 303 Introduction to Nanobiotechnology 2+0
4 Biotech. 401 Introduction to Genomics and Proteomics 3+0

(*Credit hours already counted)

8

**AGRICULTURAL ENGINEERING AND TECHNOLOGY**

1 CSE. 101 Introduction to Computer Applications 0+2

**HOME SCIENCE**

1 HD. 106 Human Values in Education 1+1

**NSS/NSO/NCC**

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

Total 125+4 (NC)=129
## SEMESTER-WISE PROGRAMME FOR 5-YEAR INTEGRATED M.Sc. (Hons.) IN BIOCHEMISTRY

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### SECOND YEAR

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### THIRD YEAR

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<td>Biotech. 303</td>
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<td>Micro. 304</td>
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Total = 17
# COURSE CURRICULUM FOR AWARD OF 3-YEAR B.Sc. DEGREE ON OPTING OUT OF 5-YEAR INTEGRATED M.Sc. (Hons.) PROGRAMME IN BOTANY (CORE COURSES)

## DEFICIENCY COURSES

### BASIC SCIENCES AND HUMANITIES

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<td>Bio. 101</td>
<td>Introduction to Biology</td>
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<tr>
<td>For PCB base</td>
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<tr>
<td>Math. 107</td>
<td>Fundamental Mathematics</td>
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</table>

### Regional Language

For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level

| Pbi. 101 | Basic Punjabi | 0+2 (NC) |

## REQUIRED COURSES

### BASIC SCIENCES AND HUMANITIES

<p>| Math. 107/Bio. 101 | Fundamental Mathematics/Introduction to Biology | 2+1/3+0 |
| Zoo. 201 | Introduction to Animal Biodiversity | 3+0 |
| Bot. 202 | Plant Morphology | 3+0 |
| Econ. 203 | Introduction to Economics and Project Evaluation | 2+0 |
| Chem. 203 | Physical and Inorganic Chemistry | 2+1 |
| Eng. 301 | Communication Skills and Technical Writing | 1+2 |
| Pbi. 101 | Basic Punjabi | 0+2 (NC) |
| Stat. 201 | Elementary Statistics | 2+0 |
| Micro.202 | Introduction to Microbiology | 3+0 |
| Phy. 202 | Fundamentals of Biophysics | 2+1 |
| Biochem. 203 | Structure and Function of Biomolecules | 3+0 |
| Bot. 203 | Systematic Botany | 3+0 |
| Zoo. 203 | Introduction to Cell Biology and Immunology | 3+0 |
| Chem. 204 | Mechanism of organic reactions | 2+1 |
| Micro. 203 | Basic Bacteriology | 2+0 |
| Biochem. 204 | Metabolism-I | 2+0 |
| Bot. 204 | Plant Histology | 2+0 |
| Micro. 204 | Basic Mycology and Phycology | 3+0 |
| Zoo. 204 | Introduction to Developmental Biology | 2+0 |
| Biochem. 205 | Metabolism-II | 3+0 |
| Bot. 205 | Botany of Economic Plants | 2+0 |
| Zoo. 304 | Fundamentals of Animal Physiology | 3+0 |
| Chem.301/Biochem. 303/ | Fundamental Organic Chemistry/Introduction to | 3+0/3+0/2+1/3+0/2+1/ |
| Bot.307/Micro. 307/Zoo.310/ | Membrane Biochemistry /Plant Biodiversity and | 2+1/2+1/2+0/2+1/2+1 |
| Zoo. 405/Agron.101/ | Environment/Bacterial Genetics/Fundamentals of | |
| PBG 102/Ent. 201/ | Animal Behaviour/Introduction to Fish and Fisheries/ | |
| Pl. Path 201 (Optional) | Elements of Agronomy/Introductory Genetics/Introductory | |
| Micro. 205 | Basic Virology | 2+0 |</p>
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<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
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<tbody>
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<td>Biochem. 302</td>
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<td>Introduction to Management and Marketing</td>
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**AGRICULTURE**

1. Agron. 101/ Elements of Agronomy/ 2+1*
2. Ent. 201 Introductory Entomology 2+1*
3. PBG 102 Introductory Genetics 2+0*
4. Pl. Path. 201 Diseases of Field Crops and their Management 2+1*
5. Biotech. 303 Introduction to Nanobiotechnology 2+0
6. Biotech. 307 Introduction to Bioinformatics 2+1
7. Biotech. 401 Introduction to Genomics and Proteomics 3+0

(*)Credit hours already counted)

**AGRICULTURE ENGINEERING AND TECHNOLOGY**

1. CSE 101 Introduction to Computer Applications 0+2

**HOME SCIENCE**

1. HD 106 Human Values in Education 1+1

**NSS/NSO/NCC**

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

Total 125+4 (NC)=129
# SEMESTER-WISE PROGRAMME FOR 5-YEAR INTEGRATED M.Sc. (Hons.) IN BOTANY

## FIRST YEAR

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<thead>
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## SECOND YEAR

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## THIRD YEAR

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### COURSE CURRICULUM FOR AWARD OF 3-YEAR B.Sc. DEGREE ON OPTING OUT OF 5-YEAR INTEGRATED M.Sc. (Hons.) PROGRAMME IN CHEMISTRY (CORE COURSES)

#### DEFICIENCY COURSES

**BASIC SCIENCES AND HUMANITIES**

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<td>Math. 107</td>
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**Regional Language**

For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level

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#### REQUIRED COURSES

**BASIC SCIENCES AND HUMANITIES**

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<td>Introduction to Economics and Project Evaluation</td>
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<td>Introduction to Cell Biology and Immunology</td>
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Agriculture

1. Agron. 101/ Elements of Agronomy/Introductory Genetics/Introductory Entomology/Diseases of Field Crops and their Management 2+1*
   Ent. 201 Introductory Entomology 2+1*
   PBG 102 Introductory Genetics 2+0*
   Pl. Path. 201 Diseases of Field Crops and their Management 2+1*
2. Biotech. 303 Introduction to Nanobiotechnology 2+0
3. Biotech. 307 Introduction to Bioinformatics 2+1
4. Biotech. 401 Introduction to Genomics and Proteomics 3+0

Total 8

(*Credit hours already counted)

Agriculture Engineering and Technology

1. CSE 101 Introduction to Computer Applications 0+2

Home Science

1. HD 106 Human Values in Education 1+1

NSS/NSO/NCC

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

Total 125+4 (NC)=129
### Semester-Wise Programme for 5-Year Integrated M.Sc. (Hons.) in Chemistry

#### First Year

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#### Second Year

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<td>1+1</td>
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<td>2+0</td>
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<td>Mgt. 421</td>
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#### Third Year

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496
COURSE CURRICULUM FOR AWARD OF 3-YEAR B.Sc. DEGREE ON OPTING OUT OF 5-YEAR INTEGRATED M.Sc. (Hons) PROGRAMME IN MICROBIOLOGY (CORE COURSES)

DEFICIENCY COURSES

BASIC SCIENCES AND HUMANITIES

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For PCM base

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For PCB base

Regional Language

For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level

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REQUIRED COURSES

BASIC SCIENCES AND HUMANITIES

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<td>Introduction to Animal Biodiversity</td>
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<td>Bot. 202</td>
<td>Plant Morphology</td>
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<td>Introduction to Economics and Project Evaluation</td>
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**AGRICULTURE**

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<td>4 Biotech. 401</td>
<td>Introduction to Genomics and Proteomics</td>
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**HOME SCIENCE**

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**NSS/NSO/NCC**

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# SEMESTER-WISE PROGRAMME FOR 5-YEAR INTEGRATED M.Sc. (Hons) in MICROBIOLOGY

## FIRST YEAR

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<tr>
<td>Math. 107/Bio. 101</td>
<td>2+1/3+0</td>
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<tr>
<td>Zoo. 201</td>
<td>3+0</td>
</tr>
<tr>
<td>Bot. 202</td>
<td>3+0</td>
</tr>
<tr>
<td>Econ. 203</td>
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</tr>
<tr>
<td>Chem. 203</td>
<td>2+1</td>
</tr>
<tr>
<td>Eng. 301</td>
<td>1+2</td>
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<tr>
<td>Pbi. 101</td>
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<tr>
<td>HD 106</td>
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Total: 19+3 (NC)= 22

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<td>Micro.202</td>
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<tr>
<td>Phys. 202</td>
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<td>Biochem. 203</td>
<td>3+0</td>
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<tr>
<td>Bot. 203</td>
<td>3+0</td>
</tr>
<tr>
<td>Chem. 204</td>
<td>2+1</td>
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Total: 22+1 (NC) = 23

## SECOND YEAR

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<tr>
<td>Bot. 205</td>
<td>2+0</td>
</tr>
<tr>
<td>Zoo. 304</td>
<td>3+0</td>
</tr>
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<td>Chem.301/Biochem. 303/</td>
<td>3+0/3+0/2+1/3+0/</td>
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Total: 19+3/2(optional) + 1(NC)= 23/22

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<td>Biochem. 206</td>
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<td>Bot. 301</td>
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<tr>
<td>Biochem. 302</td>
<td>0+3</td>
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<tr>
<td>Biotech. 307</td>
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<td>Mgt. 421</td>
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Total: 20+3 (NC) = 23

## THIRD YEAR

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<td>Biotech. 303</td>
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<tr>
<td>Micro. 304</td>
<td>3+0</td>
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<tr>
<td>Zoo. 306</td>
<td>0+3</td>
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<td>Biotech. 401</td>
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Total: 21

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<td>Micro. 401</td>
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<td>Micro. 421</td>
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Total: 17
COURSE CURRICULUM FOR AWARD OF 3-YEAR B.Sc. DEGREE ON OPTING OUT OF 5-YEAR INTEGRATED M.Sc. (Hons.) PROGRAMME IN ZOOLOGY (CORE COURSES)

DEFICIENCY COURSES

BASIC SCIENCES AND HUMANITIES

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Cr.Hrs.</th>
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<tbody>
<tr>
<td>For PCM base</td>
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<tr>
<td>Bio. 101</td>
<td>Introduction to Biology</td>
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<tr>
<td>For PCB base</td>
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<tr>
<td>Math. 107</td>
<td>Fundamental Mathematics</td>
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Regional Language

For students with domicile of Punjab who have not taken Punjabi at Matric/10+2 level

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<tr>
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REQUIRED COURSES

BASIC SCIENCES AND HUMANITIES

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<td>Fundamental Mathematics/Introduction to Biology</td>
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<td>Zoo. 201</td>
<td>Introduction to Animal Biodiversity</td>
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<td>Bot. 202</td>
<td>Plant Morphology</td>
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<td>Econ. 203</td>
<td>Introduction to Economics and Project Evaluation</td>
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<td>Chem. 203</td>
<td>Physical and Inorganic Chemistry</td>
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<td>Communication Skills and Technical Writing</td>
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<td>Basic Punjabi</td>
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<td>Introduction to Microbiology</td>
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<td>Phy. 202</td>
<td>Fundamentals of Biophysics</td>
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<tr>
<td>Biochem. 203</td>
<td>Structure and Function of Biomolecules</td>
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<td>Bot. 203</td>
<td>Systematic Botany</td>
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<td>Zoo. 203</td>
<td>Introduction to Cell Biology and Immunology</td>
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<td>Mechanism of organic reactions</td>
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<td>Micro. 203</td>
<td>Basic Bacteriology</td>
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<td>Biochem. 204</td>
<td>Metabolism-I</td>
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<td>Plant Histology</td>
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<td>Micro. 204</td>
<td>Basic Mycology and Phycology</td>
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<td>Introduction to Developmental Biology</td>
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<td>Metabolism-II</td>
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<td>Fundamentals of Animal Physiology</td>
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<td>Fundamental Organic Chemistry/ Introduction to Membrane Biochemistry / Plant Biodiversity and Environment/Bacterial Genetics/Fundamentals of Animal Behaviour/ Introduction to Fish and Fisheries/Elements of Agronomy/Introductory Genetics/Introductory Entomology</td>
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<td>Credits</td>
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<td>Fundamentals of Plant Physiology</td>
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<td>Biochem. 302</td>
<td>Basic Experiments in Biochemistry</td>
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<td>Micro. 305</td>
<td>Basic Experiments in Microbiology</td>
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<td>Fundamentals of Animal Ecology</td>
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<td>Introduction to Management and Marketing</td>
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<td>Educational Tour</td>
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<td>Micro. 304</td>
<td>Introduction to Applied Microbiology</td>
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<td>Zoo. 306</td>
<td>Basic Experiments in Zoology</td>
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<td>Systematics and Evolution of Animals</td>
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<td>Zoo. 308</td>
<td>Applied Zoology</td>
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<td>Zootechniques</td>
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<td>Form, Structure and Function of Invertebrates</td>
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<td>Form, Structure and Function of Vertebrates</td>
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<td>Zoo. 403</td>
<td>Cell Biology and Development in Animals</td>
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<td>Zoo. 404</td>
<td>Environmental Biology and Management</td>
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<tbody>
<tr>
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<td>Ent. 201</td>
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<tr>
<td>PBG 102</td>
<td>Introductory Genetics</td>
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<td>Introduction to Nanobiotechnology</td>
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<td>Introduction to Bioinformatics</td>
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<td>Introduction to Genomics and Proteomics</td>
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(*Credit hours already counted) 8

**Agriculture Engineering and Technology**

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**Home Science**

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**NSS/NSO/NCC**

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Total 126+4 (NC)=130
# SEMESTER-WISE PROGRAMME FOR 5-YEAR INTEGRATED M.Sc. (Hons) in ZOOLOGY

## FIRST YEAR

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<tr>
<th>SEM I</th>
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<td>Stat. 201, 2+0</td>
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<td>Bot. 203, 3+0</td>
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## SECOND YEAR

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<td>Biotech. 307, 2+1</td>
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<td>Zoo. 304, 3+0</td>
<td>Mgt. 421, 2+0</td>
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## THIRD YEAR

<table>
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<tr>
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<tbody>
<tr>
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<td>Zoo. 309, 1+1</td>
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<td>Biotech. 303, 2+0</td>
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<td>Zoo. 307, 2+1</td>
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