

**SRM University, Delhi-NCR, Sonapat, Haryana
Department of Agriculture Science**

**B.Sc. (Hons.) Agriculture Syllabus
I- Semester**

Fundamentals of Horticulture	
Course Code: 22AGBS101	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concepts and practices involved in production practices of horticultural crops.

Course outcome: Upon completion of the course students will be able to;

- Explain the several practices involved in cultivation and management of various horticultural crops.
- Identify various horticultural crops like fruits, vegetable, flower seeds, plant types in their natural existence.
- Categorize crops grown in different agro-climatic conditions with their classification according to various physiological and morphological features.
- Practice techniques involved in management of different horticultural crops.

Course Contents

UNIT I

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification.

UNIT II

climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment.

UNIT III

Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy.

UNIT IV

medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation of potting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Suggested Reading:

- Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).
- Neeraj Pratap Singh, 2005. Basic concepts of Fruit Science 1st Edn. IBDC Publishers.
- Gardner/Bardford/Hooker. J.R., 1957. Fundamentals of Fruit Production. Mac Graw Hill Book Co., New York.
- Edmond,J.B, Sen,T.L, Andrews,F.S and Halfacre R.G., 1963. Fundamentals of Horticulture. Tata Mc Graw Hill Publishing Co., New Delhi.
- K umar, N., 1990. Introduction to Horticulture. Rajyalakshmi publications, Nagarcoil,

Tamilnadu

- Jitendra Singh, 2002. Basic Horticulture. Kalyani Publishers, Hyderabad.
- Denisen E.L.,1957. Principles of Horticulture. Macmillan Publishing Co., New York.
- Chadha,K.L.(ICAR),2002,2001. HandbookofHorticulture. ICAR, NewDelhi
- K.V.Peter, 2009. Basics Horticulture. New India Publishing Agency
- Kausal Kumar Misra and Rajesh Kumar, 2014. Fundamentals of Horticulture. Biotech Books.
- D.K. Salunkhe and S.S. Kadam, 2013. A handbook of Fruit Science and Technology. CRC Press.
- S. Prasad and U. Kumar, 2010. A handbook of Fruit Production. Agrobios (India).
- Jitendra Singh, 2011. Basic Horticulture. Kalyani Publications, New Delhi.
- Randhawa G.S. and Mukhopadhyaya, A. 1994. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi
- Kumar N. 1997. Introduction to Horticulture. Rajyalakshmi Publications, Nagorcoil, Tamilnadu.
- Dhilon WS and Bhat ZA. Fruit Tree Physiology. Narendra Publishing house, J&K
Sharma RR, Fruit Production; Problems and Prospects, International Book Distributing Co.

Fundamentals of Plant Biochemistry and Biotechnology	
Course Code: 22AGBS102	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objectives: Provide insights on basic theory, principles, certain biochemical process and technology used for development of transgenic variety.

Course outcome: Upon completion of the course students will be able to;

- Acquainted with chemistry of biological phenomenon.
- Know the r-DNA technology for development of transgenic variety.
- Acquire knowledge about how the principles of totipotency useful for plant development.
- Understand the development of complete plant through tissue culture.

Course Contents

UNIT I

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Poly saccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.

UNIT II

Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

UNIT III

Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids.

UNIT IV

Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/Monosaccharides.

Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

Suggested Reading:

- David L. Nelson, Michael M.Cox; W.H. Freeman.Lehninger Principles of Biochemistry, 6th Edition
- Dr.U.Satyanarayana, Dr.U. Chakrapani, Biochemistry, Books and Allied (P) Ltd, Kolkata
- S.N.Gupta,Biochemistry, Rastogi Publications, First Edition, 2011
- HS Chawla, Introduction to Plant Biotechnology by (3rd Edition), Oxford & IBH Publishing Co. Pvt Ltd., New Delhi.

Fundamentals of Soil Science	
Course Code: 22AGBS103	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To acquaint with soil forming process, its properties- physical, chemical and biological, as a plant growth medium.

Course outcome: Upon completion of the course students will be able to;

- Explain the soil forming process to relate to the soil forming factors in various climatic conditions.
- List the physical properties and chemical properties that affect both plant growth and biological activity
- Explain soil as medium of plant growth, soil quality and soil health in relation to plant growth

Course Contents

UNIT I

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity.

UNIT II

Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability.

UNIT III

Soil colloids inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties.

UNIT IV

humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

Suggested Reading

- Indian Society of Soil Science. (2012). Fundamentals of Soil Science, IARI, New Delhi.

- Das, D. K.(2015). Introductory Soil Science, 4th Edition, Kalyani Publishers, New Delhi
- Sehgal,J. (2015). A Text Book of Pedology – Concepts and Applications, Kalyani Publishers,New Delhi.

Introduction to Forestry	
Course Code: 22AGBS104	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To acquire some basic knowledge on silviculture and their management.

Course outcome: Upon completion of the course students will be able to;

- Able to know about basic components of silviculture.
- Analytical skills on forest mensuration and tending operations.
- Know about the basics of agroforestry.

Course Contents

UNIT I

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.

UNIT II

Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement.

UNIT III

Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.

UNIT IV

Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

Practical

Identification of tree-species. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest-based industries.

Suggested Reading:

- Dwivedi, A.P.1980. Forestry in India, Jugal Kishore and Company, DehraDun
- Negi, S.S.1999. Agroforestry hand book, International book distributor, DehraDun.
- Ram Prakash and Drake Hocking.1986. Some favourite trees for fuel and fodder, international book distributor, Dehradun.
- Singh, S.P. 2009. Tree farming-. Agrotech Publishing academy, Udaipur.

- Singh, S.P. 2010. Favourite Agroforestry trees, Agrotech Publishing academy, Udaipur.
- Troup, T.S.1986. Silviculture of Indian trees (Vol. II & III)- International book distributor, Dehradun.

Fundamentals of Agronomy	
Course Code: 22AGBS105	Theory: Continuous Evaluation: 50 Marks
Credits: 4	Theory :End Semester Examination: 50 Marks
L T P: 3 0 1	Lab : Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: This course helps in developing the understanding of basic theory, concepts and practices involved in crop cultivation.

Learning outcome:

Upon completion of the course students will be able to

- Explain the several practices involved in field scale crop cultivation and management practices.
- Identify various crop seeds, plant types in their natural existence.
- Able to categorize crops grown in different agro-climatic conditions.
- Practice techniques involved in crop management.

Course Contents

UNIT I

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency

UNIT II

water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, logging.

UNIT III

Weeds- importance, classification, crop weed competition, concepts of weed management- principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

UNIT IV

Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agro-climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

Suggested Readings:

ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.

Reddy, T. Yellamanda & Reddy, G.H Sankara, 2015. Principles of Agronomy Kalyani Publishers,

Balasubramaniyan, P. and Palaniappan, S.P., 2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur

Reddy, T. Yellamanda and Reddy, G.H. Sankara, 2016. Principles of Agronomy (2nd edition), Kalyani Publishers, Ludhiana

Reddy, S.R., 2012. Principles of Crop Production (4th edition), Kalyani Publishers, Ludhiana.

Agricultural Heritage	
Course Code: 22AGBS106	Theory: Continuous Evaluation: 50 Marks
Credits: 1	Theory: End Semester Examination: 50 Marks
L T P: 1 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide insights on ancient and traditional methods of farming activities

Course outcome: Upon completion of the course students will be able to;

- Gained the knowledge on how agriculture was practiced in the ancient times.
- Classify the types of crop management practices- cultivation, traditional varieties, diseases, soil and water management.
- List types traditional fertilizers and their importance in crop production.
- Explain the timeline of process of migration and introduction of HYV vis-à-vis traditional varieties.

Course Contents

UNIT I

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture.

UNIT II

Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge.

UNIT III

Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications.

UNIT IV

National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

Suggested Reading:

- Choudary S.L, Sharma, G.S, and Nene, Y.L (eds). 2000. Ancient and Medieval History of Indian agriculture and its
- relevance to sustainable agriculture in the 21st century; Proceedings of the summer school held from 28 May to 17 June 1999. Rajasthan college of Agriculture, Udaipur 313001.
- Nene, Y.L (Ed). 2005. Agricultural Heritage of Asia proceedings of the international conference, 6-8 December 2004,
- Asian-Agri history Foundation, Secunderabad- 500009, Andhra Pradesh, India.
- Nene, Y.L 2007. Glimpses of Agricultural heritage of India. Asian- Agri- History Foundation, 47 – ICRISAT Colony-1
- Brig sayeed Road, Secunderabad -500009 A.P India 901PP ISBN-81-903963-0-7.

Rural Sociology & Educational Psychology	
Course Code: 22AGBS107	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 2 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concept of rural society and different types of social groups, social institutions, social change and development.

Course outcome: Upon completion of the course students will be able to;

- Understand the rural society and its significance.
- Analytical ability to examine various social institutions and its role.
- Understand the personality development traits.

Course Contents

UNIT I

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension,

UNIT II

Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development.

UNIT III

Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation,

UNIT IV

Theories of Motivation, Intelligence.

Suggested Reading:

- Adivi Reddy, A. 2006. Extension Education. Sree Lakshmi Press, Bapatla
- Chitamber, J. B. 1997. Introductory Rural Sociology. Wiley Eastern Limited, New Delhi
- Daivadeenam, P. 2006. Educational Psychology in Agriculture. Agrotech Publishing Academy, Udaipur
- Mangal, S. K. 2000. Educational Psychology. Prakash Brothers, Ludhiana.
- Ray, G. L. 2006. Extension Communication and Management. Naya Prokash/ Kalyani Publishers, Ludhiana
- VidyaBhushan and Sach Dev. D. R. 1998. An Introduction to Rural Sociology. Kitab Mahal Agencies Allahabad.

Human Value and Ethics	
Course Code: 22AGBS108	Theory: Continuous Evaluation: 50 Marks
Credits: 1	Theory: End Semester Examination: 50 Marks
L T P: 1 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To inculcate the principles and moral values of human existence and philosophy.

Course outcome: Upon completion of the course students will be able to;

- Practice ethical approach to life.
- Treat people with compassion and selflessly offer service.
- Be self-aware of spiritualism and its importance in mindfulness.
- Carry balanced mind and positive attitude.

Course Contents

UNIT I

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy.

UNIT II

Self-Exploration. Self-Awareness. Self-Satisfaction.

UNIT III

Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit.

UNIT IV

Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

Suggested Reading

- Gaur RR, Sanga IR and Bagaria GP. 2011. A Foundation Course in Human Values and Professional Ethics. Excel Books.
- Mathur SS. 2010. Education for Values, Environment and Human Rights. RSA International.
- Sharma RA. 2011. Human Values and Education – Axiology, Incultation and Research. R. Lall Book Depot.
- Sharma RP and Sharma M. 2011. Value Education and Professional Ethics. Kanishka Publishers.
- Srivastava S. 2011. Human Values and Professional Ethics. S K Kataria and Sons.
- Srivastava S. 2011. Environmental Science. S K Kataria & Sons.
- Tripathi A.N. 2009. Human Values. New Age International (P) Ltd Publishers.
- R.S. Nagarajan. Text Book on Professional Ethics & Human Values.
- D.R. Kiran. Professional Ethics & Human Values
- Veerendra Kumar. Human Values and Professional Ethics.
- M.Govindarajan. Engineering Ethics.

Comprehension and Communication Skills in English	
Course Code: 22AGBS209	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Train in use of English as communication language and writing technical content.

Course outcome: Upon completion of the course students will be able to;

- Effectively speak and use English in conversation in an academic environment.
- Reliably demonstrated the ability to use the conventions of grammar when creating paragraphs.
- Effective in comprehension of a technical writing, develop manuscripts and reports.

Course Contents

UNIT I

War Minus Shooting- The Sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw.

UNIT II

Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations.

UNIT III

Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing.

UNIT IV

The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

Suggested Reading:

- Balasubramanian, T. 1989. A Text Book of Phonetics for Indian Student, Orient Longman, New Delhi.
- Balasubramanyam, M. 1985. Business Communication. Vani Education Books, New Delhi.
- Jean Naterop, B. and Rod Revell. 1977. Telephoning in English. Cambridge University Press, Cambridge.
- Krishna Mohan and Meera Banerjee. 1990. Developing Communication Skills. Mc Millan India Ltd. New Delhi.

- Krishanswamy, N and Sriraman, T. 1985. Current English for Colleges. Mc Millan India Ltd., Madras.
- Narayanaswamy V R. 1979. Strengthen Your Writing. Orient Longman, New Delhi.
- Sharma R C and Krishna Mohan. 1978. Business Correspondence. Tata Mc Graw Hill Publishing Company, New Delhi.

Introductory Biology	
Course Code: 22AGBS110	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To sensitize students about the basics of biology in special reference to botany.

Course outcome: Upon completion of the course students will be able to;

- Know about the various parts of an angiospermic plant.
- Know about the evolutionary process and binomial classification.
- Explain 3 important families such as, Brassicaceae, Fabaceae and Poaceae.

Course Contents

UNIT I

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics.

UNIT II

Binomial nomenclature and classification Cell and cell division.

UNIT III

Morphology of flowering plants. Seed and seed germination.

UNIT IV

Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

Morphology of flowering plants – root, stem and leaf and their modifications. Inflorescence, flower and fruits. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants - Brassicaceae, Fabaceae and Poaceae.

Suggested Reading:

- Biology – Raven P, Mason Johnson G B, Losos J. B, Singer. S.S, 10th edition, 2014. McGraw Hill Publications.
- M.G. Simpson, 2006. Plant systematics. Elsevier Publications
- H. C. Gangulee 1972 College Botany 4th edition.
- C. Dutta 1964 A class book of Botany Botany for Degree Students, Oxford University Press, Calcutta.
- N. T. Gill. 1966. Agricultural Botany. 2nd edition.

Elementary Mathematics	
Course Code: 22AGBS111	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 2 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To introduce basic mathematical theories useful to understand the mathematical approaches used in agriculture.

Course outcome: Upon completion of the course students will be able to;

- Explain the mathematical functions.
- Apply general form of equations in calculations.

Course Contents

UNIT I

Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.

UNIT II

Differential Calculus Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it).

UNIT III

Integral Calculus: Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

UNIT IV

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

Suggested Reading:

- MVSL DN Raju and Dr. K .V. Ramana – Engineering Mathematics-1
- MVSL DN Raju and Dr. K .V. Ramana – Engineering Mathematics-2
- Text Book for A.P Intermediate Mathematics – Paper (IA & IIB).

SRM University, Delhi-NCR, Sonapat, Haryana
Department of Agriculture Science

B.Sc. (Hons.) Agriculture Syllabus
II- Semester

Fundamentals of Genetics	
Course Code: 22AGBS201	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide the concept of fundamental biology principles occurring inside the cell and its influence on character expression.

Course Outcome: Upon completion of the course students will be able to;

- Explain inheritance and expression of characters.
- Explain how variation occurs within living organisms.
- Acquainted with genetic terminology and its application.
- Gained the knowledge on the genetic principles behind the development of variety

Course Contents

UNIT I

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere.

UNIT II

special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping.

UNIT III

Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance.

UNIT IV

Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two-point test cross and three-point test cross data). Study on sex linked inheritance in *Drosophila*. Study of models on DNA and RNA structures.

Suggested Reading

Pundhan Singh. (2006). Genetics. Kalyani Publishers, Ludhiana.

Singh, B.D. (2015). Fundamentals of Genetics. Kalyani Publishers, Ludhiana.

Gupta, P.K. (2007). Genetics. Rastogi Publications, Meerut.

Khanna, V.K. (2002) Genetics Numerical Problems. Kalyani publishers. 2nd edition.
Pundhan Singh. (2011).Genetics at a Glance. Kalyani Publishers, Ludhiana.
Verma, P.S and Agarwal, P.K. (2013) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Pvt. Ltd., Kolkata.
Snustad, D.P and Simmons, M.J. (2010) Principles of Genetics. 5th Ed. John Wiley & Sons, 111, River Street, Hoboken, NJ, U.S.A.
Strickberger, M.W. (2006) Genetics. Prentice- Hall of India Pvt. Ltd., New Delhi.

Agricultural Microbiology	
Course Code: 22AGBS202	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory :End Semester Examination: 50 Marks
L T P: 1 0 1	Lab : Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory on microorganisms: Beneficial and harmful to crop plants.

Course outcome: Upon completion of the course students will be able to;

- Understand the milestones in the history of microbiology leading to discovery of microorganisms.
- Know about different artificial methods of culturing the microorganisms and different sterilization methods.
- Gained knowledge on different plant growth promoting microorganisms.
- Knowledge on mushrooms and their cultivation.

Course Contents

UNIT I

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.

UNIT II

Bacterial genetics: Genetic recombination-transformation, conjugation and transduction, plasmids, transposon. Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles.

UNIT III

Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere.

UNIT IV

Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of Rhizobium from legume root nodule. Isolation of Azotobacter from soil. Isolation of Azospirillum from roots. Isolation of BGA. Staining and microscopic examination of microbes.

Suggested Reading

- Pelczar, J.r., M.J.E.C.S.Chan and Krieg, N.R. 2015. Microbiology. (5th Ed.) McGraw Hill Publishers, New York.
- Prescott, L.M., Harley, J.P. and Klein, D.A. 2014. Microbiology. (9th Ed.) McGraw Hill Publishers, New York.
- Madigan, M., Martinko, J.M and Parker, J. Brock 2015 Biology of Microorganisms (14Ed.) Prentice hall of India Pvt Ltd., New Delhi.
- Subba Rao, N.S. 2014. Soil Microbiology: (4th Ed.) Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

- James, C and Natile, S. 2014. Microbiology A Laboratory Manual: (10th Ed.) Pearson India Education Services Pvt. Ltd., South Asia.
- Aneja, K.R. 2011. Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International (P) Ltd., Publishers, New Delhi.

Introductory Soil and Water Conservation Engineering	
Course Code: 22AGBS203	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide insights on theory and concepts of engineering employed on soils and water conservation.

Course outcome: Upon completion of the course students will be able to;

- Visualize the importance of soil and water conservation.
- Explain the types of erosion and their impact on agricultural landscapes.
- Categorize the methods employed to control the erosion caused by various agents.

Course Content

UNIT I

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures.

UNIT II

Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund.

UNIT III

Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques.

UNIT IV

Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

Suggested Reading

- Jagadishwar Sahay - Elements of Agricultural Engineering.
- Surendra Singh. Farm Machinery - Principles and Applications. ICAR Publication.
- S.C.Jain and C.R.Rai. Farm Tractor – Maintenance and Repair. Standard Publishers, 1705-B, Nai Sarak, Delhi – 110006
- Ojha, T. P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers, 16/893, East Park Road, Karol Bagh, New Delhi – 110005

Fundamentals of Crop Physiology	
Course Code: 22AGBS204	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory and concept related to plant biochemistry

Course outcome: Upon completion of the course students will be able to;

- Understand different process involved in different physiological process found in plants responsible for its growth
- Accumulate knowledge on different metabolisms found in plants.
- Knowledge about different growth regulators and different aspects of growth and development of major crops.

Course Contents

UNIT I

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.

UNIT II

Photosynthesis: Light and Dark reactions, C₃, C₄ and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain.

UNIT III

Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses.

UNIT IV

Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infrared Gas Analyser (IRGA).

Suggested Reading:

- Taiz, L. and Zeiger, E. 2010. Plant Physiology 5th edition, Sinauer Associates, Sunderland, MA, USA.
- Gardner, F.P., Pearce, R.B., and Mitchell, R.L. 1985. Physiology of Crop Plants. Scientific Publishers, Jodhpur.
- Noggle, G.R. and Fritz, G.J., 1983. Introductory Plant Physiology. 2nd Edition. Prentice Hall Publishers, New Jersey, USA.

Fundamentals of Agricultural Economics	
Course Code: 22AGBS205	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 2 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Expose students to basic principles of economics applicable in agricultural sector.

Course outcome: Upon completion of the course students will be able to:

- Develop ideas of the basic characteristics of Indian economy, its potential on natural resources, understanding agriculture as the foundation of economic growth and development.
- Understand factor of marketing, various types of investment analysis.
- Compute and assess real situation of economy and income pattern.
- Understand relationship between investment and savings.

Course Contents

UNIT I

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

UNIT II

Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply.

UNIT III

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and program on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation.

UNIT IV

Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. Tax: meaning, direct and

indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Suggested Reading

- Dewett, K.K. and Varma, J.D. (2003). Elementary Economic Theory. S. Chand and Co., New Delhi.
- Dewett, K.K and Chand, A. (2009). Modern Economic Theory. S.Chand and Co., New Delhi.
- Paul A. Samuelson and Nordhus. (2010). Economics. 19th Edition, Tata-Mc Graw Hill Education, New Delhi.
- Jhingan, M.L. (1990). Advanced Economic Theory. Vikas Publishing House, New Delhi
- Koutsoyiannis. (2015). Modern Microeconomics. Tata Mac-Graw Hill Publishers, New Delhi

Fundamentals of Plant Pathology	
Course Code: 22AGBS206	Theory: Continuous Evaluation: 50 Marks
Credits: 4	Theory: End Semester Examination: 50 Marks
L T P: 3 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concepts and practices involved in crop protection against plant diseases.

Course outcome: Upon completion of the course students will be able to;

- Explain basic principles and concepts of plant pathology and familiarize students with basic vocabulary of plant disease management.
- List major groups of organisms that cause plant diseases and phenology of diseased plants.
- Explain the different infection, reproduction, survival mechanism and spread of different pathogens.
- Categorize different biotic and abiotic causes of diseases and different diseases caused due to them.
- Practice techniques involved in integrated disease management.

Course Contents

UNIT I

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

UNIT II

Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.

Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites.

UNIT III

Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.) Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis.

UNIT IV

Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipment's and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

Suggested Reading

- Dube, H. C. (2013). An Introduction to Fungi.4th (Edition). Scientific Publishers, Jodhpur, India.
- Webster, J.(1989). Introduction to fungi. Cambridge Univ. Press (for life cycles of Fungi)
- Dasgupta, M. K. (1987). Principles of Plant Pathology. Allied Publ. Pvt Ltd. p985. (for rust life cycles)
- Alexopoulos, Mims and Blackwell Introductory Mycology (4th Edition)
- Agrios, G. N. 2006. Plant Pathology. Elsevier Publishers, New Delhi.
- Chaube, H.S. and Ramji Singh. (2001). Introductory Plant Pathology. International Book Distribution Co., Lucknow.
- Mehrotra, R.S. (1980). Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Singh, R.S. (2002). Introduction to Principles of Plant Pathology. Oxford & IBH Publ. Co. Pvt. Ltd., New Delhi.

Fundamentals of Entomology	
Course Code: 22AGBS207	Theory: Continuous Evaluation: 50 Marks
Credits: 4	Theory: End Semester Examination: 50 Marks
L T P: 3 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide basic knowledge on insect's morphology, taxonomy and pest control principles.

Course outcome: Upon completion of the course students will be able to;

- Know the morphology and physiology of a typical insect body.
- Acquaint with the basic principles of insect pest control.
- Gained insights on the insect taxonomy and classification of insects as economically beneficial and pests.

UNIT I

Part – I

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda into classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

UNIT II

Part-II

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors—temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

UNIT III

Part III

Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control—importance, hazards and limitations. Recent methods of pest control, repellents, anti-feedants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.

UNIT IV

Part – IV

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Subspecies, Species, Genus, Family and Order. Classification of class Insecta into Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophoridae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera:

Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Suggested Reading

- Chapman, R.F. (2013) *Insects: Structure and Function*. Ed by Simpson, S. J. and Douglas, A. C. Cambridge Univ. Press, UK.
- Richards, O.W. and Davies, R.G. (1977). *Imm's General Text Book of Entomology* (Vol. I and II). Chapman and Hall, London.
- Wigglesworth, V.B. (2013). *Insect Physiology*. Springer (Originally published by Chapman and Hall, London, 1974).
- Pant, N.C. and Ghai, S. (1988). *Insect Physiology and Anatomy*. ICAR, New Delhi.
- Kapoor, V.C. (2008). *Theory and Practice of Animal Taxonomy*. Oxford and IBH Publishing, New Delhi.
- Charles A Triplehom and Norman F. (2005). *Borror and De Long's Introduction to the Study of Insects*. Johnson Thomson Brooks/Cole Publishing. U.S.A.
- Snodgrass, R.E. (2001). *Principles of Insect Morphology*. CBS Publishers & Distributors, Delhi.
- Timbhare, D.B. (2015). *Modern Entomology*, Himalaya Publishing House.

Fundamentals of Agricultural Extension Education	
Course Code: 22AGBS208	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: This course is intended to orient students with the concepts of extension education and its importance in agriculture development and also to expose the students with various rural development program aimed at poverty alleviation and analysis. Besides the students will be learning about new innovations and transfer through agricultural extension in India.

Course outcome: Upon completion of the course students will be able to;

- Explain the concepts of extension.
- Define community development program.
- List the extension system of SAUs and ICAR.
- Understand the market-led-extension.
- Gained knowledge on cyber extension, farming situation based extension.
- Acquired skills to examine the rural leadership and PRA survey.

UNIT I

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Program planning- Meaning, Process, Principles and Steps in Program Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development program launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.).

UNIT II

New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc. Rural Development: concept, meaning, definition; various rural development program launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions.

UNIT III

Monitoring and evaluation: concept and definition, monitoring and evaluation of extension program; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies.

UNIT IV

Communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipment's and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to

understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Suggested Reading

Adivi Reddy, A. 2006. Extension Education. Sree Lakshmi Press, Bapatla.

Dahama, O.P. and Bhatnagar, O.P. 1999. Extension and Communication for Development. Oxford & IBH Private Limited, New Delhi/Mumbai.

Ganesh, R., Mohammad Iqbal and Ananda Raja. 2003. Reaching the Unreached – Basics of Extension Education. Associate Publishing Company, New Delhi.

Jalihal, K.A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publishing House, New Delhi.

Ray, G.L. 2006. Extension Communication and Management. NayaProkash/Kalyani Publishers, Kalkatta/Ludhiana.

Communication Skills and Personality Development	
Course Code: 22AGBS209	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: In this course students will learn about the concept, meaning and process of communication and various methods. Students will also learn various communication skills and about personality development.

Course outcome: Upon completion of the course students will be able to;

- Explain various communication methods and communication skills.
- Acquired competency to write the technical articles.
- Understand various personality traits.
- Gained the competency to organize seminars and conferences.

UNIT I

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication.

UNIT II

listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

UNIT III

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking.

UNIT IV

Group discussion. Organizing seminars and conferences.

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

Suggested Reading:

- Dangi K.L., S.S. Sisoda, Pravesh Singh Chauhan and Yogita Ranavat. A Text Book of Communication Skills. Agrotech Publications.
- Mangal S.K. 2016. Essentials of Educational Psychology. PHI Learning Private Ltd., New Delhi.
- Nirajkumar. 1997. A Genesis of Behavioural Science. Gyan Publishing House, New Delhi.
- Eric Berne. 1964. Games People Play-The Psychology of Human Relationship. Grove Press Publishers.
- Thomas Anthony Harris. 1967. I am Ok You are Ok. Harper Publishers.
- Scott Bill. 1981. Skills of Negotiating.
- Goleman Daniel. 1995. Emotional Intelligence.
- Ratan Reddy B and Supriya Reddy. Soft Skills for Professional Excellence.
- Shivkhera. 2002. You can win. MacMillan Publishing Company. New Delhi
- Shivaraman K. 2009. Communication Skills. APH publications.

SRM University, Delhi-NCR, Sonapat, Haryana
Department of Agriculture Science

B.Sc. (Hons.) Agriculture Syllabus
III- Semester

Crop Production Technology-I (Kharif Crops)	
Course Code: 22AGBS301	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory :End Semester Examination: 50 Marks
L T P: 2 0 1	Lab : Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide basic knowledge about production of kharif crops.

Course outcome: Upon completion of the course students will be able to.

- List the Kharif crops and know about the morphological characters of various kharif crops.
- Explain about soil and climatic requirements of different kharif crops.
- Describe the cultural practices associated with various kharif crops.
- Identify the yield contributing characters and calculation of yield

Course Contents

UNIT I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops.

UNIT II

Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-pigeon pea, mungbean and urdbean

UNIT III

oilseeds- groundnut, and soybean

UNIT IV

fibre crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeon pea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops.

Suggested Reading

- Rajendra Prasad. (2006).Text book of field crops production. ICAR, New Delhi.
- Reddy, S.R. and Reddi Ramu. 5th edition. (2016). Agronomy of field crops. Kalyani publishers, Ludhiana.
- Gururaj hunsigi and Krishna, K.R.(2007).Scientific field crop production. Oxford & IBH Publishing Co. Pvt. Ltd.
- De Datta, S.K. (1981).Principles and practices of rice Production. John Wiley and Sons, New York
- Singh, C., Singh, P and Singh, R. (2003). Modern techniques of raising field crops. Oxford & IBH Publishing house, New Delhi.
- Panda, S.C. (2014). Agronomy of fodder and forage crops, Kalyani publishers, Ludhiana

Fundamentals of Plant Breeding	
Course Code: 22AGBS302	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, genetic principles and methods applied for development of variety.

Outcome: Upon completion of the course students will be able to;

- Acquainted with floral biology of crop.
- Explain about basic principles of variety development.
- Know different methods applied in different crop for development of variety.

Course Contents

UNIT I

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility-genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self-pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept

UNIT II

Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes-Ear to row method, Modified Ear to Row, recurrent selection schemes.

UNIT III

Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses.

UNIT IV

Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids.

Suggested Reading

- Phundan Singh. (2014). Essentials of Plant Breeding. Kalyani Publishers, New Delhi.

- Singh, B.D. (2015). Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
- Gupta, S.K. (2010). Plant Breeding Theory and Techniques. Wiley India Pvt. Ltd. New Delhi.
- Allard, R.W. (2010). Principles of Plant Breeding. John Wiley and Sons, New York.
- Poehlman, J.M and Borthakur, D. (1995). Breeding of Asian Field Crops. Oxford and IBH Publishing Co., New Delhi.
- Sharma, J.R. (1994). Principles and Practice of Plant Breeding. Tata McGraw Hill, Publishing Company Ltd., New Delhi.

Agricultural Finance and Co-Operation	
Course Code: 22AGBS303	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory :End Semester Examination: 50 Marks
L T P: 2 0 1	Lab : Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To have general knowledge on various financial and marketing institutions.

Course outcome: Upon completion of the course students will be able to;

- Understand agriculture as the foundation of economic growth and development.
- Understands source of finance, both public and private.
- Demonstrate role of government to correct market failures and possible advantages of public financing.
- Understand conditions of financial markets and its impact in the economy.
- Understand role and significance of non-banking financial institutions, foreign exchange rate with its impact on various sector.

Course Contents

UNIT I

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC.

UNIT II

Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit.

UNIT III

Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.

UNIT IV

Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

Practical

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal- A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and

its value added products. Seminar on selected topics.

Suggested Reading:

- Johil S.S. and C.V. Moore. (1970). Essentials of Farm Financial Management. Today and Tomorrow Printers and Publishers, New Delhi.
- John, J. Hampton (1983). Financial Decision Making: Concepts, Problems and Cases, of India. New Delhi.
- Mamoria, C.B. and R.D. Saksena. (1973). Co-operatives in India. Kitab Mahal, Allahabad,
- Mamoria, C.B. and Saxena. Agricultural Problems in India. Kitab Mahal, Allahabad
- Mukhi, H R. (1983). Cooperation in India and Abroad. New Heights Publishers, New Delhi.
- Muniraj, R. (1987). Farm Finance for Development, Oxford & IBH Publishing Company Ltd., New Delhi,
- Subba Reddy, S. and P. Raghuram (2005). Agricultural Finance and Management. Oxford & Publishing Company Private Ltd., New Delhi,
- Subba Reddy, S., Raghu Ram., P., Sastry, T.V.N and Bhavani Devi, I. (2016). Agricultural Economics. Oxford & IBH Publishing Company Private Ltd., New Delhi.
- Pandey, U.K. Agricultural Finance in India.
- William, G. Murray and Nelson Aarson, G. Agricultural Finance. The Iowa State University Press, Ames, Iowa state University press Ames, IOWA.

Agri-Informatics	
Course Code: 22AGBS304	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide exposure to the computer-based MIS and data relevant to agriculture and interactive software's.

Course outcome: Upon completion of the course students will be able to;

- Explain importance of ICT in agriculture.
- Use of agriculture related database to develop analytics.
- Develop interactive apps. to provide services.
- Develop decision making process to support agricultural activities.
- Develop database of all aspects of agriculture.

Course Contents

UNIT I

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components

UNIT II

Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes.

UNIT III

IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information.

UNIT IV

Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.

Practical

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management. Use of MS-WORD and MS Powerpoint for creating, editing and presenting a scientific Document. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

Suggested Reading:

- John Walkenbach, Herb Tyson, Michael R. Groh, Faithe Wempen, Microsoft Office 2010 Bible
- Bangia, Learning Ms Office 2010
- Prof. Satish Jain and M. Geetha, MS-Office 2010 Training Guide
- Kate Shoup, Microsoft Office 2010
- Melanie Gass, It's All about You! Office 2010
- Nancy Conner and Matthew MacDonald, Office 2010: The Missing Manual

Farm Machinery and Power	
Course Code: 22AGBS305	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Discussed detailed knowledge on various farm machineries and their functioning principles.

Course outcome: Upon completion of the course students will be able to;

- List types of farm machineries and their working principles.
- Repair and troubleshooting of machineries
- Identify suitable tillage equipment's to be used with power operated machines.
- Gained analytical skills to analyze the cost of power usage in land preparation.

Course Contents

UNIT I

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems

UNIT II

Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement

UNIT III

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples

UNIT IV

Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

Suggested Reading

- Jagdishwar Sahay - Elements of Agricultural Engineering. Surendra Singh. Farm Machinery - Principles and Applications.ICAR Publication
- S.C.Jain and C.R.Rai. Farm Tractor – Maintenance and Repair. Standard Publishers,

1705-B, Nai Sarak, Delhi – 110006

- Ojha, T. P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers, 16/893, East Park Road, Karol Bagh, New Delhi – 110005

Production Technology for Vegetables and Spices	
Course Code: 22AGBS306	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concepts and practices involved in production practices of vegetable and spice crops.

Course outcome: Upon completion of the course students will be able to

- Explain the several practices involved in cultivation and management of different vegetable and spice crops.
- Identify different seeds of vegetable and spice crops with their plant types in their natural existence.
- Classify different vegetable and spice crops according to their agro-climatic requirement, physiological and morphological features.
- Practice techniques involved in management of different vegetable and spice crops.

Course Contents

UNIT I

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield.

UNIT II

Physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol).

UNIT III

Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables.

UNIT IV

Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation.

Practical

Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation

Suggested Reading:

Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. Modern Technology in Vegetable Production. New India Publishing Agency, New Delhi.

Neeraj Pratap Singh, .2007. Basic Concepts of Vegetable Science. International Book Distributing Co. New Delhi. Academic Press, New Delhi.

Nempal Singh, Singh, D.K., Singh, Y.K. and Virendra Kumar. 2006. Vegetable Seed Production Technology. International Book Distributing Co. Lucknow.

Prem Singh Arya and S. Prakash 2002. Vegetables Growing in India. Kalyani publishers, New

Delhi

Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. II & III Naya Prokash, Kolkata.

Shanmugavelu, K.G., N. Kumar and K.V. Peter 2005. Production Technology of Spices and Plantation Crops. Agrobios (India), Jodhpur.

Environmental Studies and Disaster Management	
Course Code: 22AGBS307	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To get an insight into various environmental components including ecosystem, ecological succession and disaster management.

Course outcome: Upon completion of the course students will be able to;

- List various types of energy sources (renewable and non-renewable).
- Describe various components of an ecosystem.
- Explain various types of pollution sources and their management.
- Gained knowledge on various kinds of disasters and their management.

Practical

Pollution case studies. Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/ Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

Course Contents

UNIT I

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT II

Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

UNIT III

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Program. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

UNIT IV

Disaster Management

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Suggested Reading:

- Bharucha, E. 2005. Text book of Environmental Studies for undergraduate courses. University Grants Commission, New Delhi.
- Anjaneyalu, Y. 2004. Introduction to Environmental Science. BS Publications, Hyderabad, A.P. India.

Statistical Methods	
Course Code: 22AGBS308	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To understand the types of data, basic methods used in data analysis and computer-based software's used in data collection, management and interpretation of data.

Course outcome: Upon completion of the course students will be able to;

- Explain the data and data classification.
- Organize data in excel sheet for analysis and interpretation using various statistical methods.
- Perform sampling, data collection and analysis to apply test of significance.
- Develop field scale testing design and collect the primary empirical data.
- Use of computer based statistical software to analyze a set of data.

Course Contents

UNIT I

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

UNIT II

Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

UNIT III

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

UNIT IV

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

Practical

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data).

Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2×2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

Suggested Reading:

- Nageswara Rao, G 2007. Statistics for Agricultural Sciences. B S Publications,

Hyderabad

- Rangaswamy, R 1995. A Text Book of Agricultural Statistics. New Age International (P) Limited, Hyderabad.
- Chandel SRS, Hand Book of Agricultural Statistics. Achal Prakashan Mandir publications, New Delhi.
- Agrawal, B. L. Programmed Statistics. 2nd Edition, New Age International Publishers, Hyderabad.

Livestock & Poultry Management	
Course Code: 22AGBS309	Theory: Continuous Evaluation: 50 Marks
Credits: 4	Theory: End Semester Examination: 50 Marks
L T P: 3 0 2	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To understand the different components of the animal husbandry practices in relation to agriculture

Course outcome: Upon completion of the course students will be able to;

- Explain what animal husbandry and its components.
- Gained knowledge on types of farm animals, fodder types and animal improvement.
- How to organize the poultry production on farm?
- Gained knowledge on animal health management and medication to protect animals from diseases.

Course Contents

UNIT I

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers

UNIT II

Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.

UNIT III

Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

UNIT IV

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipment's. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

**SRM University, Delhi-NCR, Sonapat, Haryana
Department of Agriculture Science**

**B.Sc. (Hons.) Agriculture Syllabus
IV- Semester**

Crop Production Technology-II (Rabi crops)	
Course Code: 22AGBS401	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide basic knowledge about production of rabi crops.

Course outcome: Upon completion of the course students will be able to;

- Know about the morphological characters of various rabi crops.
- Explain about soil and climatic requirements of different rabi crops.
- Describe the cultural practices associated with various rabi crops
- Identify the yield contributing characters and calculation of yield.

Course Contents

UNIT I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops

UNIT II

cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane

UNIT III

medicinal and aromatic crops-mentha, lemon grass and citronella

UNIT IV

Forage crops-berseem, lucerne and oat.

Practical

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

Suggested Reading

- Rajendra Prasad.(2006) .Text book of field crops production. ICAR, New Delhi.
- Reddy, S.R and Reddi Ramu. 5th edition.(2016). Agronomy of field crops. Kalyani publishers, Ludhiana.
- Gururaj hunsigi and Krishna, K.R..(2007). Scientific field crop production. Oxford & IBH Publishing Co. Pvt. Ltd.
- De Datta, S.K.(1981). Principles and practices of rice Production. John Wiley and Sons, New York
- Singh, C., Singh, P and Singh, R. (2003) Modern techniques of raising field crops. Oxford & IBH Publishing house, New Delhi.
- Panda S.C. (2014) Agronomy of fodder and forage crops, Kalyani publishers, Ludhiana.

Production Technology for Ornamental Crops, MAPs and Landscaping	
Course Code: 22AGBS402	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory :End Semester Examination: 50 Marks
L T P: 1 0 1	Lab : Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concepts and practices involved in production practices of Ornamental crops, Medicinal and aromatic plants with different style and features of landscape designing.

Course outcome: Upon completion of the course students will be able to;

Explain the several practices involved in cultivation and management of different ornamental crops, medicinal and aromatic plants.

Identify different ornamental crops, medicinal and aromatic plants seed with their plant types in their natural existence.

Classify different ornamental crops, medicinal and aromatic plants according to their agro-climatic requirement, physiological and morphological features.

Practice techniques involved in management of different ornamental crops, medicinal and aromatic plants

Go through different styles and features of landscaping with computer aided designing of landscape (CAD) and turf management.

Course Contents

UNIT I

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

UNIT II

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

UNIT III

Package of practices for loose flowers like marigold and jasmine under open conditions.

UNIT IV

Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical

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

Suggested Reading:

- Bose, T.K. 1999. Floriculture and Landscaping. Naya Prakash, Kolkatta.
- Bose, T.K. and Yadav, L.P. 1992. Commercial Flowers. Naya Prakash, Kolkatta.
- Randhawa, G.S. and Mukhopadhyaya, A. 1994. Floriculture in India. Allied Publishers

Pvt. Ltd., New Delhi

- Chattopadhyay, S.K. 2007. Commercial Floriculture. Gene-Tech Books, New Delhi
- Srivastava, H.C. 2014. Medicinal and Aromatic Plants. ICAR, New Delhi.
- Kumar, N., Abdul Khader, J.B.M, Rangaswamy, P and Irulappan, I. 2004. Introduction to Spices, Plantation Crops,
- Medicinal and Aromatic Crops. Oxford and IBH publishing Co, New Delhi.

Renewable Energy and Green Technology	
Course Code: 22AGBS403	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Comprehensively describe the non-renewable and renewable energy sources and their relevance in agriculture.

Course outcome: Upon completion of the course students will be able to;

- List energy sources relevant to agricultural needs.
- Understand the production of renewable energy sources and usage at various levels in agriculture.
- Technologies available for large scale production of renewable energy.
- Source the gadgets relevant to produce renewable energy.

Course Content

UNIT I

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

UNIT II

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

UNIT III

Introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater

UNIT IV

Application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

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

Suggested Reading

- Rai, G.D. (2004). Non-conventional Energy Sources. Khanna Publishers, New Delhi.
- Rajput, R. K. (2012). Non-conventional Energy Sources. S. Chand Publishers.
- Ojha, T.P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers, New Delhi.
- Rathore, N.S., Mathur, A.N. and Kothari, S. Alternate Sources of Energy. ICAR Publication.
- Chakravarty, A. and Amalendu Chakraverty. 1989 Biotechnology and Other Alternative Technologies for Utilization of Biomass-Agricultural Wastes. 1st edition, Oxford and IBH. Publishers, New Delhi

Problematic Soils and their Management	
Course Code: 22AGBS404	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 2 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide exposure to problematic soils and their distribution in relation their suitability for crop production.

Course outcome: Upon completion of the course students will be able to;

- Establish the natural distribution of problematic soils in the country and extent in an agro-climatic zones.
- Classify the problematic soils on the basis of their physical, chemical and biological properties that are not suitable for crop cultivation.
- Suggest suitable management practices to reclaim the problematic soils.

Course Contents

UNIT I

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

UNIT II

Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

UNIT III

Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils

UNIT IV

Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

Practical

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

Suggested Reading

- Indian Society of Soil Science. (2012). Fundamentals of Soil Science, IARI, New Delhi.
- Das, D. K. (2015). Introductory Soil Science. 4th Edition, Kalyani publishers, New Delhi
- Soils of Andhra Pradesh, Monograph of I.V. Subbarao.

Production Technology for Fruit and Plantation Crops	
Course Code: 22AGBS405	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concepts and practices involved in production practices of fruit and plantation crops.

Course outcome: Upon completion of the course students will be able to;

- Explain the several practices involved in cultivation and management of different fruit and plantation crops.
- Identify different seeds of fruit and plantation crop with their plant types in their natural existence.
- Classify different fruit and plantation crops according to their agro-climatic requirement, physiological and morphological features.
- Practice techniques involved in management of different fruit and plantation crops.

Course Contents

UNIT I

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

UNIT II

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

UNIT III

Production technologies for the cultivation of minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry

UNIT IV

Production technologies for the cultivation of plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

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

Suggested Reading:

- Bose, T.K. and Mitra, S.K. 1990. Fruits – Tropical and Sub-tropical. Naya Prakashan, Calcutta.
- Chattopadhyaya, P. K. Year. Text Book on Pomology (Fundamentals of Fruit Growing). Kalyani Publishers, Ludhiana.
- Bijendra Singh. 2012. Horticulture at a Glance. Kalyani Publishers, Ludhiana

Principles of Seed Technology	
Course Code: 22AGBS406	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 1 0 2	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, practices and technology involved in seed production of different crop.

Outcome: Upon completion of the course students will be able to;

- Explain about basic principles behind seed production.
- Know how different classes of seed are produced.
- Know how certified seed is produced by farmer.
- Acquired knowledge on different practices and processes for quality seed production.

Course Contents

UNIT I

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

UNIT II

Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

UNIT III

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.

UNIT IV

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

Practical

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

Suggested Reading

- Agarwal, P.K. (1994) Principles of Seed technology. ICAR, New Delhi.
- Agarwal, P.K and Dadlani, M. (1986) Techniques in Seed Science and Technology.

South Asian Publishers, New Delhi.

- Agarwal, R.L. (1995). Seed Technology. Oxford and IBH Publication Co., New Delhi.
- Dharendra Khare and Mohan S. Bhale. (2007). Seed Technology. Scientific Publishers (India), Jodhpur.
- Thomson, J.R. (1979). An introduction of Seed Technology. Leonard Hill, London

Farming System and Sustainable Agriculture	
Course Code: 22AGBS407	Theory: Continuous Evaluation: 50 Marks
Credits: 1	Theory: End Semester Examination: 50 Marks
L T P: 1 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide knowledge about integrated farming and other new concepts related to farming.

Course outcome: Upon completion of the course students will be able to;

- Explain farming systems suitable for various agro-climatic regions.
- Identify the tools required for determining the efficiency of various cropping and farming systems.
- Complementary use of on farm residues for improving resource use efficiency.
- Learn new concepts and types of farming.

Course Contents

UNIT I

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance

UNIT II

Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system

UNIT III

Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment

UNIT IV

Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

Suggested Reading

- Arun K. Sharma. (2006) A hand book of organic farming - Agrobios (India) Jodhpur
- Jayanthi C, Devasenapathy P and Vinnila, C. (2008) Farming systems principles and practice. Satish serial publishing house, Delhi
- Panda S.C. (2011) Cropping and farming systems. Agrobios (India) Jodhpur.
- Ruthenburg, H. (1980) Farming systems in the tropics. Oxford university press

Agricultural Marketing, Trade and Prices	
Course Code: 22AGBS408	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To have basic knowledge on agricultural marketing, trade and prices.

Course outcome: Upon completion of the course students will be able to;

- Identify basic difference between inter regional and international trade.
- Demonstrate role of government to correct market failures and possible advantages of public financing.
- Understand conditions of financial markets and its impact in the economy
- Understand role and significance of non-banking financial institutions, foreign exchange rate with its impact on rural economy.

Course Contents

UNIT I

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

UNIT II

product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark)

UNIT III

Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading

UNIT IV

Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications

on Indian agriculture; IPR.

Practical

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

Suggested Reading

- S S Acharya and N L Agarwal. (2012). Agricultural Marketing in India. Oxford & IBH Publications Co. Pvt. Ltd., New Delhi.
- S S Acharya and N L Agarwal. Agricultural Price: Analysis and Policy. Oxford & IBH Publications Co. Pvt Ltd., New Delhi.
- Subba Reddy, S., P.Raghu Ram., Sastry, T.V.N and Bhavani Devi, I.(2016). Agricultural Economics. Oxford & IBH Publishing Company Private Ltd., New Delhi,
- Kahlon, A.S and Tyagi.D S. (1983). Agricultural Price Policy in India. Allied PublishersPvt. Ltd., New Delhi.
- Mamoria, C.B. and Joshi. R L. (1995). Principles and Practices of Marketing in India. Kitab Mahal, Allahabad
- Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithileswar Jha. 2009. Marketing Management: A South Asian Perspective. International 13th edition. Pearson Prentice Hall

Introductory Agro-meteorology and Climate Change	
Course Code: 22AGBS409	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide basic knowledge about atmospheric phenomenon and their relation with crop production.

Course outcome: Upon completion of the course students will be able to;

- Understand about various atmospheric weather variables and their measurement.
- Explain how weather variables effect crop production.
- Explain climate change and their impact on agriculture.
- Emphasize the importance of weather forecasting in crop production.

Course Contents

UNIT I

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

UNIT II

Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature. Energy balance of earth.

UNIT III

Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heatwave and cold wave.

UNIT IV

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

Practical

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

pan evaporation and evapotranspiration. Computation of PET and AET.

Suggested Reading

- Radhakrishnamurthy, V. (2002) Basic Principles of Agricultural meteorology. B.S Publications, Koti, Hyderabad.
- Radhakrishnamurthy, V. (2016). Principles and practices of agricultural disaster management. B.S Publications, Koti, Hyderabad.
- Reddy, S.R. (2014). Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana, Punjab.

**SRM University, Delhi-NCR, Sonapat, Haryana
Department of Agriculture Science**

**B.Sc. (Hons.) Agriculture Syllabus
V- Semester**

Principles of Integrated Pest and Disease Management	
Course Code: 22AGBS501	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic principles and procedure of integrated pest and disease management.

Course outcome: Upon completion of the course students will be able to;

- Explain the various concepts, principles and tools of IPM.
- Explain the methods for detection and diagnosis of insect pest and diseases and to calculate the dynamics of economic injury level.
- Gained competency to survey and forecast different insect pest and diseases.
- Gained skills to develop and validate different modules of IPM

Course Contents

UNIT I

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis.

UNIT II

Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment.

UNIT III

Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module.

UNIT IV

Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM program. Case histories of important IPM program.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichoderma, Pseudomonas, Trichogramma, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers fields.

Suggested Reading

- Dhaliwal, G. S. and Ramesh Arora .(2001). Integrated pest management: Concepts and approaches, Kalyani Publishers Ludhiana.
- Metcalf, R. L .and Luckman, W. H. (1982). Introduction to insect pest management. Wiley inter science publishing, New York.

- Larry P Pedigo (1991). Entomology and pest management, Prentice Hall of India Private Ltd., New Delhi.
- Venugopala Rao, N., Umamaheswari, T., Rajendraprasad, P., Naidu, V.G and Savithri, P. (2004). Integrated Insect Pest Management. Agrobios (India) Limited, Jodhpur.
- Chaube, H.S. and Ramji Singh.(2001). Introductory Plant Pathology. International Book Distribution Co., Lucknow.
- Mehrotra, R.S. (1980). Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Singh, R.S. (2002). Introduction to Principles of Plant Pathology. Oxford & IBH Publ.Co.P. Ltd., New Delhi.
- Vidyasekharan, P. (1993). Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi.
- Y. L. Nene and P.N. Thaplial, (1993)., Fungicides in Plant Disease Control. Oxford and IBH Publishing Co.

Manures, Fertilizers and Soil Fertility Management	
Course Code: 22AGBS502	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory :End Semester Examination: 50 Marks
L T P: 2 0 1	Lab : Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide detailed information on types of fertilizers of different chemical properties and their essential nutrient content and forms.

Course outcome: Upon completion of the course students will be able to;

- Explain the criteria of essentiality and available forms of nutrients in soils.
- List types of fertilizers and classify them in terms of nutrient source.
- Explain the factors affecting their transformation in soils and availability
- Use methods soil analysis for nutrient contents and fertilizer recommendations.
- Identify suitable fertilizer application methods and nutrient use efficiency.

Course Contents

UNIT I

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.

UNIT II

Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants.

UNIT III

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.

UNIT IV

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils. Estimation of soil extractable S in soils. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Suggested Reading

- Indian Society of Soil Science. (2012) (1995). Manures and Fertilisers. Agril. Publishing House, Nagpur
- Samuel Tisdale, Nelson Werner L, Beaton James D and Havlin John L. 2005. Soil

Fertility and Fertilizers: An Introduction to Nutrient Management, Macmillian Publishing Co., New York.

- D. K. Das (2014). Introductory Soil Science. Kalyani Publishers, New Delhi landscape (CAD) and turf management.

Pests of Crops and Stored Grains and their Management	
Course Code: 22AGBS503	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To gain knowledge about the insect pests of the cultivated crops and stored food products and their management practices.

Course outcome: Upon completion of the course students will be able to;

- Know about important insect and non-insect pests of field and horticultural crops and stored food materials and their management.
- Know integrated pest management tactics for important cultivated crops.

Course Content

UNIT I

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and;

UNIT II

Management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments

UNIT III

Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management.

UNIT IV

Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

Suggested Reading

- Vasantharaj David, B. and Rama Murthy V.V. (2016). Elements of Economic Entomology, Popular Book Depot, Coimbatore. 80
- Vasantharaj David, B and Aanathakrishnan, T.N. (2006). General and Applied Entomology. Tata McGraw-Hill Publishing House, New Delhi.
- Nair, M.R.G.K. (1986). Insects and Mites of crops in India. Indian Council of Agricultural Research New Delhi.

- Ramakrishna Ayyar, T.V. (1963). Handbook of Economic Entomology for South India. Government Press, Madras.
- Dennis S Hill (1987). Agricultural Insect Pests of tropics and their control, Cambridge Universtiy Press, New York
- Upadhyaya K.P. and Kusum Dwivedi. (1996). A Text Book of Plant Nematology. Aman Publishing House, Meerut.
- Khare, S.P. (1993). Stored Grain Pests and their Management. Kalyani Publishers, Ludhiana.
- Atwal, A.S. (1976). Agricultural Pests of India and South East Asia. Kalyani Publishers, Ludhiana.

Diseases of Field & Horticultural Crops & their Management-I	
Course Code: 22AGBS504	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, symptoms and practices involved diseases of field and horticultural crops and their management.

Course outcome: Upon completion of the course students will be able to;

- Differentiate different diseases of field and horticultural crops.
- Identify the diseases and diagnose its management.
- Explain the different symptoms, pathogens, disease cycle and management of different diseases of field and horticultural crops.

Course Contents

UNIT I

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic;

UNIT II

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & greengram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.

UNIT III

Symptoms, etiology, disease cycle and management of major diseases of following crops: Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight.

UNIT IV

Symptoms, etiology, disease cycle and management of major diseases of following crops: Horticultural Crops: Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well-mounted specimens.

Suggested Reading

- Rangaswami, Gand K.Mahadevan. (2001). Diseases of crop plants in India. Prentice Hall of India Pvt.Ltd, New Delhi.
- Singh, R.S. (2005). Plant Diseases. Oxford & IBH Publications, New Delhi

Crop Improvement – I (Kharif)	
Course Code: 22AGBS505	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, practices and methods applied for improvement of field crop.

Outcome: Upon completion of the course students will be able to;

- Know about floral biology of different crops.
- Acquiring knowledge how different breeding method will be applied depending on nature of crop.
- Know commercial importance of field crop.

Course Contents

UNIT I

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

UNIT II

Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops

UNIT III

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

UNIT IV

Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in Kharif crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Suggested Reading

- Allard, R.W. 1960. Principles of Plant Breeding. John Wiley & Sons, New York.
 Phundan Singh. 2006. Essential of Plant Breeding. Kalyani Publishers, Ludhiana.
 Poehlman, J.M and Borthakur, D. 1995. Breeding of Asian Field Crops. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
 Sharma, J.R. 1994. Principles and Practices of Plant Breeding. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

Kaloo,G. 1994. Vegetable Breeding. Panima Educational Book Agency,New Delhi.
Kumar,N. 2006. Breeding of Horticultural Crops-Principles and Practices. New India Publishing Agency, New Delhi
George Acquaah. 2012. Principles of Plant Genetics and Breeding. Blackwell Publishing Ltd., USA 8. Mono graphs available on specific crops.

Entrepreneurship Development and Business Communication	
Course Code: 22AGBS506	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: The first part of the course is intended to provide overall picture of planning and development of enterprises for extending sustainable livelihoods for rural people. The second part of the course is structured to help the students to gain knowledge and skills in different concepts and techniques of communication and management in extension organizations.

Course outcome: Upon completion of the course students will be able to;

- Explain concepts of Entrepreneurship, Entrepreneur and Enterprises
- List opportunities of Agri-enterprises
- Gained managerial skills and business communication skills

Course Contents

UNIT I

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs, SWOT Analysis & achievement motivation.

UNIT II

Government policy and programs and institutions for entrepreneurship development. Impact of economic reforms on Agribusiness/Agri-enterprises, Entrepreneurial Development Process; Business Leadership Skills

UNIT III

Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management.

UNIT IV

Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for Agri-entrepreneurship and rural enterprise.

Practical

Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

Suggested Reading:

- Anil Kumar, S., Poornima, S. C., Mini, K., Abraham and Jayashree, K. 2003 Entrepreneurship Development. New Age International Publishers, New Delhi
- Bhaskaran, S. 2014. Entrepreneurship Development & Management. Aman Publishing House, Meerut
- Gupta, C.B. 2001. Management: Theory and Practice. Sultan Chand and Sons, New Delhi
- Indu Grover 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Publishing Academy, Udaipur

- Khanka, S.S. 1999. Entrepreneurship Development. S. Chand and Co., New Delhi
- Mary Coulter 2008. Entrepreneurship in Action. Prentice Hall of India Pvt. Ltd., New Delhi
- Mohanty, S.K. 2009. Fundamentals of Entrepreneurship. Prentice Hall of India Pvt. Ltd., New Delhi
- Prasad, R. 2003. Entrepreneurship - Concepts and Cases. I C F A I Publications, Hyderabad
- SagarMondal and Ray, G. L. 2003. Text Book of Entrepreneurship and Rural Development. Kalyani Publishers, Ludhiana
- Singh, D. 1995. Effective Managerial Leadership. Deep and Deep Publications, New Delhi
- Vasanta Desai. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publishing House, New Delhi
- Vasanta Desai. 2000. Dynamics of Entrepreneurial Development and Management. Himalaya Publishing House, New Delhi

Geo-informatics, Nanotechnology and Precision Farming	
Course Code: 22AGBS507	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To learn about new technologies and how they are useful in farming.

Course outcome: Upon completion of the course students will be able to;

- Manage the fields according to site specific issues related to various aspects of crop production.
- Examine the utility of simulation Models for optimization of Agricultural Inputs.
- Gained knowledge on nanotechnology and their use in agriculture.

Course Contents

UNIT I

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics definition, concepts, tool and techniques; their use in Precision Agriculture.

UNIT II

Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation.

UNIT III

Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture.

UNIT IV

Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

Suggested Reading

- Pradeep. T. (2007). NANO: The Essentials: Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Publishing Company Limited, New Delhi
- Lillesand, T.M. and Kiefer, R. W. (1994) Remote sensing and image interpretation. (3rd edition), John Wiley and Sons.
- Anji Reddy, M. (2006). Text book of Remote sensing and Geographical Information Systems, (3rd edition), B.S.Publications, Hyderabad.

Practical Crop Production-I (Kharif Crops)	
Course Code: 22AGBS508	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 0 0 2	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Practical aspects of kharif crop production under field condition.

Course outcome: Upon completion of the course students will be able to;

- Calculate seed rate and learn about methods of sowing.
- Learn about various agrochemicals used in different kharif crops and their rate of application.
- Select irrigation practices and methods of harvesting of various kharif crops.

Practical

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

Suggested Reading

- Rajendra Prasad. (2006). Text book of field crops production. ICAR, New Delhi.
- Reddy, S.R and Reddi Ramu. 5th edition. (2016). Agronomy of field crops. Kalyani publishers, Ludhiana.
- Gururaj hunsigi and Krishna, K.R.(2007).Scientific field crop production. Oxford & IBH Publishing Co. Pvt. Ltd.
- De Datta, S.K. (1981). Principles and practices of Rice Production. John Wiley and Sons, New York
- Chidda Singh, Singh, P and Singh, R. (2003). Modern techniques of raising field crops. Oxford & IBH Publishing house, New Delhi.
- Panda S.C. (2014). Agronomy of fodder and forage crops, Kalyani publishers, Ludhiana

Intellectual Property Rights	
Course Code: 22AGBS509	Theory: Continuous Evaluation: 50 Marks
Credits: 1	Theory: End Semester Examination: 50 Marks
L T P: 1 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide insights on importance of IPR and governing institutions

Course outcome: Upon completion of the course students will be able to;

- Explain the importance of IPR in agriculture.
- Categorize types of IPR and licensing procedure.
- Gained expertise on process of application for IPR for an agricultural produce.
- Explain the importance of biodiversity and obtaining the IPR.

UNIT I

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.

UNIT II

Types of Intellectual Property and legislations covering IPR in India-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

UNIT III

Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights.

UNIT IV

Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Suggested Reading

- Acharya, N.K. 2014. Text book of Intellectual Property Rights. Asia Law House, Hyderabad.
- Loganathan, E.T. 2012. Intellectual Property Rights. New Century Publications, New Delhi.
- Rosedar, S.R.A. 2016. Intellectual Property Rights. Lexis Nexis (2nd Ed.), Nagpur Course Contents

**SRM University, Delhi-NCR, Sonapat, Haryana
Department of Agriculture Science**

**B.Sc. (Hons.) Agriculture Syllabus
VI- Semester**

Rainfed Agriculture and Watershed Management	
Course Code: 22AGBS601	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To learn about management of crops in rainfed areas.

Course outcome: Upon completion of the course students will be able to;

- Categorize the extent of rainfed area in India and their soil and climatic condition.
- Manage extreme weather conditions by contingent planning.
- Gained the skills to manage watersheds and various water harvesting techniques.
- Gained the knowledge suitable crop raising techniques for rainfed areas.

Course Contents

UNIT I

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India; Soil and climatic conditions prevalent in rainfed areas

UNIT II

Soil and water conservation techniques, Drought: types, effect of water deficit on physio-morphological characteristics of the plants, Crop adaptation and mitigation to drought

UNIT III

Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions.

UNIT IV

Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

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

Suggested Reading

- Reddy, S. R and Prabhakar Reddy, G. (2015). Dryland Agriculture. Kalyani Publishers.
- Arnon, I. (1972) Crop Production in Dry Regions (Vol. I), Leonard Hill Pub. Co, London.
- Dhruva Narayana, V.V., Sastry, G.S. and Patnaiak, V.S. (1999) Watershed Management in India. ICAR, New Delhi.
- Jeevananda Reddy, S. (2002) Dryland Agriculture in India: An agro-climatological and agro-meteorological perspective. BS publications

Protected Cultivation and Secondary Agriculture	
Course Code: 22AGBS602	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To provide insights on the protected cultivation and its importance in agriculture.

Course outcome: Upon completion of the course students will be able to;

- Explain the importance of protected cultivation in current scenario of agriculture.
- Explain the principle involved in protected cultivation.
- Identify the technologies available for protected cultivation.
- Identify crops suitable for cultivation using protected cultivation technologies.
- Understand the precision farming under protected cultivation.
- Gained knowledge on technology cost estimation and economic analysis.
- List the gadgets useful for remote monitoring of climate of protected cultivation technologies

Course Contents

UNIT I

Green house technology: Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipment's, materials of construction for traditional and low-cost green houses.

UNIT II

Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis.

UNIT III

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

UNIT IV

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

Practical

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

Suggested Reading

- Radha Manohar, K and Igathinathane. C. Greenhouse Technology and Management,

2nd Edition, BS Publications.

- Tiwari, G.N. Greenhouse Technology for Controlled Environment. Narosa Publishing house Pvt.Ltd.
- Singh Brahma and Balraj Singh.,(2014). Advances in Protected Cultivation, New India Publishing Company.
- Sahay, K.M. and Singh, K.K. (1994). Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
- Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
- Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.

Diseases of Field & Horticultural Crops & their Management-II	
Course Code: 22AGBS603	Theory: Continuous Evaluation: 50 Marks
Credits: 3	Theory: End Semester Examination: 50 Marks
L T P: 2 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, symptoms and practices involved diseases of field and horticultural crops and their management.

Course outcome: Upon completion of the course students will be able to;

- Differentiate different diseases of field and horticultural crops.
- Identify the diseases and diagnose its management.
- Explain the different symptoms, pathogens, disease cycle and management of different diseases of field and horticultural crops.

Course Content

UNIT I

Symptoms, etiology, disease cycle and management of following diseases:

Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng; Sunflower: Sclerotinia stem rot and Alternaria blight.

UNIT II

Symptoms, etiology, disease cycle and management of following diseases:

Field Crops: Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

UNIT III

Symptoms, etiology, disease cycle and management of following diseases:

Horticultural Crops:

Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic

UNIT IV

Symptoms, etiology, disease cycle and management of following diseases:

Horticultural Crops: Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium. Note: Students should submit 50 pressed and well-mounted specimens.

Suggested Reading

- Rangaswami, G & Mahadevan, K. (2001). Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd, New Delhi

- Singh, R.S. (2005). Plant Diseases. Oxford & IBH Publications, New Delhi
- Pathak, V.N. (2001). Diseases of Fruit crops. Oxford & IBH Publications, New Delhi
- Singh, R.S. (1999). Diseases of Vegetable crops. Oxford & IBH Publications, New Delhi
- Chaube, H.S and V.S. Pundhir (2012). Crop Diseases & Their Management. PHI Pvt.Ltd, New Delhi

Post-harvest Management and Value Addition of Fruits and Vegetables	
Course Code: 22AGBS604	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, concepts and practices involved in Post-Harvest Management and Value Addition of Fruits and Vegetables.

Course outcome: Upon completion of the course students will be able to;

- Explain the several practices involved in Post-Harvest Management and Value Addition of Fruits and Vegetables.
- Practice techniques involved in Post-Harvest Management and Value Addition of Fruits and Vegetables
- Prepare different processed product of fruit and vegetable.
- Know about different standards and guideline, specification for preparation of different processed product from fruits and vegetables.

Course Contents

UNIT I

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses; Preharvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.

UNIT II

Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric).

UNIT III

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

UNIT IV

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

Practical

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

Suggested Reading:

- Rathore, N.S., Mathur, G.K., Chasta, S.S. 2012. Post-harvest Management and Processing of Fruits and Vegetables. ICAR, New Delhi.
- Srivastava, R.P. and Sanjeev Kumar. 2002. Fruit and Vegetable Preservation: Principles and Practices. International Book Distribution Company, Lucknow.
- Giridharilal, G.S., Siddappa and Tondon, G.L. 2007. Preservation of Fruits and

Vegetables. ICAR, New Delhi.

- Mitra, S.K. 2005. Post-Harvest Physiology and Storage of Tropical and Subtropical Fruits. CABI Publishers, Kolkata.

Management of Beneficial Insects	
Course Code: 22AGBS605	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To gain knowledge about rearing and management of beneficial insects.

Course outcome: Upon completion of the course students will be able to;

- Know the rearing of honeybees and developing an apiary.
- Know about the cultivation of lac culture and sericulture.
- Gained entrepreneurial abilities regarding apiculture, lac culture and sericulture.

Course Contents

UNIT I

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

UNIT II

Role of pollinators in cross pollinated plants. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.

UNIT III

Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection. Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.

UNIT IV

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

Practical

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

Suggested Reading

- Chapman, R. F (2013) Insects: Structure and Function. Ed by Simpson, S. J. and Douglas, A. C. Cambridge Univ. Press, UK.
- Richards, O.W. and Davies, R.G (1977). Imm's General Text Book of Entomology (Vol. I and II). Chapman and Hall, London

Crop Improvement – II (Rabi)	
Course Code: 22AGBS606	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on basic theory, practices and methods applied for development stress resistance variety.

Outcome: Upon completion of the course students will be able to;

- Able to know Plant Genetic Resources of different crops.
- Acquired knowledge on how fundamental mechanisms behind resistance and how this resistance transferred from wild to cultivated variety.

Course Contents

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Practical

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

Suggested Reading

- Allard, R.W. (1960). Principles of Plant Breeding. John Wiley & Sons, New York.
- Phundan Singh. (2006). Essential of Plant Breeding. Kalyani Publishers, Ludhiana. 54
- Poehlman, J.M and Borthakur, D. (1995). Breeding of Asian Field Crops. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- Sharma, J.R. (1994). Principles and Practice of Plant Breeding. Tata McGraw-Hill Publishing Co. Ltd., New Delhi. Kalloo,
- G. (1994). Vegetable Breeding. Panima Educational Book Agency, New Delhi.
- Kumar, N. (2006). Breeding of Horticultural Crops - Principles and Practices. New India Publishing Agency, New Delhi.

- George Acquah. (2012). Principles of Plant Genetics and Breeding. Blackwell Publishing Ltd., USA

Practical Crop Production-II (Rabi Crops) 2	
Course Code: 22AGBS607	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 0 0 2	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Practical aspects of rabi crop production under field condition

Course outcome: Upon completion of the course students will be able to;

- Calculate seed rate and learn about methods of sowing.
- Learn about various agrochemicals used in different rabi crops and their rate of application.
- Select irrigation practices and methods of harvesting of various rabi crops.

Practical

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

Suggested Reading

- Rajendra Prasad. (2006) Text book of field crops production. ICAR, New Delhi.
- Reddy, S.R and Reddi Ramu. 5th edition. (2016). Agronomy of field crops. Kalyani publishers, Ludhiana.
- Gururaj hunsigi and Krishna, K.R.(2007).Scientific field crop production. Oxford & IBH Publishing Co. Pvt. Ltd.
- De Datta, S.K. (1981).Principles and practices of rice Production. John Wiley and Sons, New York
- Chidda Singh, Singh, P and Singh, R. (2003). Modern techniques of raising field crops. Oxford & IBH Publishing house, New Delhi.
- Panda S.C. (2014). Agronomy of fodder and forage crops, Kalyani publishers, Ludhiana.Course Contents

Principles of Organic Farming	
Course Code: 22AGBS608	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: To learn about principles and practices of organic farming.

Course outcome: Upon completion of the course students will be able to;

- Understand the fundamentals of nutrient use, insect, pest, disease and weed management under organic mode Of production.
- Familiarize with organic certification process and standards of organic products set by various agencies.
- Identify agencies related with organic production practices in India.
- Understand the socio-economic status of farmers and environmental quality due to adoption of organic production practices.

UNIT I

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

UNIT II

Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming.

UNIT III

Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming.

UNIT IV

Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

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

Suggested Reading

- Arun K. Sharma. (2002) .A Hand book of organic farming. Agrobios, India.
- Palaniappan, S.P and Annadurai, K. (1999).Organic farming-Theory and Practice. Scientific publishers, Jodhpur, India.
- Mukund Joshi and Prabhakarasetty, T.K. (2006). Sustainability through organic farming. Kalyani publishers, New Delhi.
- Balasubramanian, R., Balakishnan, K and Siva Subramanian, K. (2013). Principles and practices of organic farming. Satish Serial Publishing House.
- Tarafdar, J.C., Tripathi, K.P and Mahesh Kumar (2009). Organic agriculture. Scientific Publishers, India.

- Tiwari, V.N., Gupta, D.K., Maloo, S.R and Somani, L.L. (2010). Natural, organic, biological, ecological and biodynamic farming. Agrotech Publishing Academy, Udaipur.
- Dushyent Gehlot. (2005). Organic farming- standards, accreditation, certification and inspection. Agrobios, India.

Farm Management, Production and Resource Economics	
Course Code: 22AGBS609	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 1 0 1	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: This course designed to provide students with economic concepts that can be applied to management decisions using farm and ranch situations and to develop skills in planning, budgeting, financial analysis and investment analysis.

Course outcome: Upon completion of the course students will be able to;

- Implement decisions, rules to determine conditions that maximize profit.
- Use budgeting concepts to develop whole farm plants from enterprise budget
- Identify alternative business organization.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan

and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

Suggested Reading

- Bishop, C.E. and W. D. Tousaint. (1958). Introduction to Agricultural Economic Analysis. John Wiley and Sons, London.
- Heady, Earl O. 1964. Economics of Agricultural Production and Resource Use. Prentice Hall of India, Private Limited, New Delhi
- S.S. Johl, J.R. Kapur. 2006. Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.
- Kahlon, A.S. and Karam Singh. 1965. Principles of Farm Business Management. Kalyani Publishers, New Delhi.
- Raju, V.T. and D.V.S. Rao. 2006. Economics of Farm Production and Management. Oxford & IBH Publishing Co. Pvt. Limited, New Delhi

Principles of Food Science and Nutrition	
Course Code: 22AGBS6010	Theory: Continuous Evaluation: 50 Marks
Credits: 2	Theory: End Semester Examination: 50 Marks
L T P: 2 0 0	Lab: Continuous Evaluation: 50 Marks
Prerequisite: Nil	Lab End Semester Examination: 50 Marks

Objective: Provide insights on the science of food and nutrition

Course outcome: Upon completion of the course students will be able to;

- Understand the nutritional value of food items.
- Gained knowledge on food spoilage and microorganisms involved in food spoilage.
- Gained knowledge on food processing and preservation methods.
- Explain malnutrition due to imbalanced food habits.

Course Contents

UNIT I

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

UNIT II

Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods).

UNIT III

Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders.

UNIT IV

Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, new trends in food science and nutrition.

Suggested Reading

- Sumati R. Mudambi, Shalini M. Rao and M.V. Rajagopal. 2006. Food Science, 2nd Ed New Age International (P) Limited, New Delhi.
- Martin Eastwood. 2003. Principles of Human Nutrition. Blackwell Science Ltd., Oxford.
- Norman N. Potter. 1998. Food Science, 5th Ed. Springer Science+ Business Media, New York.
- Michael J. Pelczar Jr., E.C.S. Chan and Noel R. Krieg. 1998. Microbiology, 5th Ed. Tata McGraw-Hill Education, New Delhi.
- William C. Frazier and Dennis C. Westhoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.
- L.E. Casida Jr. 1968. Industrial Microbiology. New Age International Publishers, New Delhi.
- P. Fellows. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, Boca Raton, FL, USA.
- Marcus Karel and Darvl B. Lund. 2003. Physical Principles of Food Preservation, 2nd Ed. Marcel Dekker, Inc., NY, USA.

- Gerald Wiseman. 2002. Nutrition and Health. Taylor & Francis, London. An Introduction to Nutrition, v. 1.0

**B.Sc. (Hons.) Agriculture
VII- Semester**

B.Sc. (Hons.) Agriculture

VII- Semester

S. No	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)		
	Activities	No. of weeks	Credit Hours
1.	General orientation & On campus training by different faculties	1	14
2.	Village attachment	8	
3.	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
4.	Plant clinic	2	2
5.	Agro-Industrial Attachment	3	4
6.	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		20	20

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working.
- Educational tour will be conducted in break between IV & V Semester or VI & VII Semester

RAWE Component-I

Village Attachment Training Programme

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE Component –II

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post

harvest-processing-value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on trainings under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

B.Sc. (Hons.) Agriculture
VIII- Semester

B.Sc. (Hons.) Agriculture

VIII- Semester

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the **VIII semester**.

Sl. No.	Title of the module	Credits
1	Production Technology for Bioagents and Biofertilizer	0+10
2	Seed Production and Technology	0+10
3	Mushroom Cultivation Technology	0+10
4	Soil, Plant, Water and Seed Testing	0+10
5	Commercial Beekeeping	0+10
6	Poultry Production Technology	0+10
7	Commercial Horticulture	0+10
8	Floriculture and Landscaping	0+10
9	Food Processing	0+10
10	Agriculture Waste Management	0+10
11	Organic Production Technology	0+10
12	Commercial Sericulture	0+10

NOTE: In addition to above ELP modules other important modules may be given to the students by SAUs

Evaluation of Experiential Learning Programme/ HOT

Sl. No.	Parameters	Max Marks
1	Project Planning and Writing	10
2	Presentation	10
3	Regularity	10
4	Monthly Assessment	10
5	Output delivery	10
6	Technical Skill Development	10
7	Entrepreneurship Skills	10
8	Business networking skills	10
9	Report Writing Skills	10
10	Final Presentation	10
Total		100