

PROGRAMME OUTCOME

- **Scientific, economic and environmental principles underpinning agricultural production and land use.**
- **Students are trained about the most modern methods used in crop improvement like fertilizers, soil testing, plant tissue culture.**
- **The course apart from training in scientific skills also trains in marketing skills of agriculture products .**
- **Under this study the students are exposed to real life rural settings with the aim to develop a sense of awareness among the students so that they can understand the problems of farmers and rural people.**

COURSE OUTCOME

Fundamentals of Horticulture

The term HORTICULTURE is derived from two Latin words -HORTUS meaning -GARDEN and —CULTURA meaning _CULTIVATION. In ancient days the gardens had protected enclosures with high walls or similar structures surrounding the houses. The enclosed places were used to grow fruit, vegetables, flowers and ornamental plants. Therefore, in original sense “Horticulture refers to cultivation of garden plants within protected enclosures”.

Horticulture is a science and technique of production, processing and merchandizing of fruits, vegetables, flowers, spices, plantations, medicinal and aromatic plants.

Fundamentals of Plant Biochemistry and Biotechnology

Biochemistry is the study of chemical processes in living organisms. Biochemistry governs all living organisms and living processes. By controlling information flow through biochemical signaling and the flow of chemical energy through metabolism, biochemical processes give rise to the seemingly magical phenomenon of life. Much of biochemistry deals with the structures and functions of cellular components such as proteins, carbohydrates, lipids, nucleic acids and other bio molecules although increasingly processes rather than individual molecules are the main focus.

- This course is designed to expose the students to the basics and productive advancements in the arena of plant biochemistry and biotechnology with an emphasis to horticultural crops.
- Understanding the basics of plant biochemistry is the core of biotechnology which is involved in the manipulation of the crop plants that meet the needs of today’s people. This course helps to understand the basics of biochemical principles and protocols used

in genetic improvement of horticultural crops besides state-of-the-art biotechnological approaches. While preparing the course materials, it was kept in mind that completion of this course should enable the student to understand and undertake any biotech strategy that involves the manipulation of horticultural crop for a trait of interest.

Fundamentals of Soil Science

Fundamentals in Soil Science is an introductory soil science course designed for the practitioner hoping to build their knowledge and skills in the topics most needed for a fundamental understanding of Soil Science. This course is designed to provide an overview of the fundamental concepts in soil science: Genesis, Classification and Morphology, Physics, Chemistry, Fertility, Biology, and Land Use.

Introduction to Forestry

Forestry is the science, skills and activities related to the human utilisation of the big plants called trees and the land on which they are growing. This implies that there are two main components in the art of Forestry, the human beings and the trees. The interaction between people and forest is basic for survival for both parties. People have found that forests are basic for the life and elementary socio-economic demands are covered there.

Comprehension & Communication Skills in English

In the era of globalization, communication plays a vital role in the smooth functioning of any organization; hence the need to impart communication skills to undergraduate student assumed greater importance. This course has been designed under different units to improve standards in performing the communicative tasks. Précis writing, Business Correspondence, Report Writing are major forms of written communication in the professional world where as the chapters on Verbal Ability, Functional Grammar and Usage are intended to help the student to take care of the mechanics of writing, which enhance the effectiveness of written communication.

Fundamentals of Agronomy

The etymology of the word Agronomy owes its origin to ancient Greece. It is a compound word combining *Agros* (field) and *Nomos* (to manage). In modern terminology however the word has come to mean and denote a branch of science dealing with all aspects of crop cultivation and production. A study of agronomy often involves a summoning of resources from related disciplines such as Botany, Soil Science, Irrigation, Plant protection, Plant Genetics and Breeding, Agro-meteorology etc. In a more fundamental sense it can be categorized as an applied

Science, the object of which is crop cultivation and management for the purpose of producing food for humans, feed for animals as well as raw materials for the industry.

Introductory Biology

This course will provide students with a basic understanding of an introductory level biology experience. It will contain video lectures and fill-in lecture notes, as well as end of section quizzes. It is up to you how you would like to experience this course, fast-paced for upcoming test prep or more slow-paced for learners that want to take their time.

The course will cover most major aspects of a biology experience in high school or introductory college course. However, It can be useful to students (at any level) looking for additional help or prep in biology topics.

Introductory Elementary Mathematics

Elementary mathematics consists of mathematics topics frequently taught at the primary or secondary school levels.

There are five basic strands in Elementary Mathematics: Number Sense and Numeration, Measurement, Geometry & Spatial Sense, Patterning & Algebra, and Data Management & Probability. These five strands are the focus of Mathematics education from grade one till grade 8.

Agriculture Heritage

The patterns and practices of growing food are constantly adapting to time, place, and local culture, but the ways of growing are informed by heritage. For millennia communities of farmers, herders, fishers and forest people have developed complex, diverse, and locally adapted agricultural systems. These systems have been managed with time-tested, ingenious combinations of techniques and practices that have usually led to community food security, and the conservation of natural resources and biodiversity.

Rural Sociology & Educational Psychology

Rural Sociology is a specialized field of sociology. It is the study of life in rural environment, which systematically studies rural communities to discover their conditions and tendencies to formulate the principles of progress. It is limited to various aspects of rural society in the study of rural social relationships. The knowledge of rural sociology is very important in agricultural extension for the following reasons:

The basic purpose of agricultural extension is changing the behavior of farmers as desired. Therefore, knowledge and understanding of rural people (farmers) is essential. It is the rural sociology which provides this knowledge and understanding about the farmer vis-à-vis rural social system in which he lives.

It helps in devising an agricultural extension plans for farmers.

Human Values & Ethics

Environmental ethics is the philosophical discipline that considers the moral and ethical relationship of human beings to the environment. Environmental ethics helps define man's moral and ethical obligations toward the environment. But **human values** become a factor when looking at environmental ethics. Human values are the things that are important to individuals that they then use to evaluate actions or events.

NSS/NCC/Physical Education & Yoga Practices

National Service Scheme (NSS) was introduced in 1969 with the primary objective of developing the personality and character of the student youth through voluntary community service. 'Education through Service' is the purpose of the NSS. The ideological orientation of the NSS is inspired by the ideals of Mahatma Gandhi. Very appropriately, the motto of NSS is **"NOT ME, BUT YOU"**. An NSS volunteer places the **'community'** before **'self'**.

The Indian parliament passed the National Cadet Corp Act in 1948, thus creating the national Cadet Corp (NCC). The motto of the NCC is unity and discipline. The aims of the national cadet Corp are

- **To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook.**

The ultimate goal of Yoga is *moksha* (liberation), although the exact definition of what form this takes depends on the philosophical or theological system with which it is conjugated.

"Yoga has five principal meanings-

1. Yoga, as a disciplined method for attaining a goal;
2. Yoga, as techniques of controlling the body and the mind;
3. Yoga, as a name of one of the schools or systems of philosophy (*darśana*).
4. Yoga, in connection with other words, such as "hatha-, mantra-, and laya-," referring to traditions specializing in particular techniques of yoga;
5. Yoga, as the goal of Yoga practice.

II sem

Fundamentals of Genetics

Genetics is the study of genes, genetic variation, and heredity in living organisms. It is generally considered a field of biology, but intersects frequently with many other life sciences and is

strongly linked with the study of information systems. The discoverer of genetics is Gregor Mendel, a late 19th-century scientist and Augustinian friar. Mendel studied "trait inheritance", patterns in the way traits are handed down from parents to offspring. He observed that organisms (pea plants) inherit traits by way of discrete "units of inheritance". This term, still used today, is a somewhat ambiguous definition of what is referred to as a gene.

Agricultural Microbiology

Agricultural microbiology is a field of study concerned with plant-associated microbes. It aims to address problems in agricultural practices usually caused by a lack of biodiversity in microbial communities. An understanding of microbial strains relevant to agricultural applications is useful in the enhancement of factors such as soil nutrients, plant-pathogen resistance, crop robustness, fertilization uptake efficiency, and more. The many symbiotic relationships between plants and microbes can ultimately be exploited for greater food production necessary to feed the expanding human populace, in addition to safer farming techniques for the sake of minimizing ecological disruption.

Soil and Water Conservation Engineering

The course deals with the engineering principles involved in soil and water conservation. It includes the classification of the water erosion, and the agronomical and engineering measures adopted for erosion control. The design of bunds and terraces are dealt in detail, followed by gully control measures. The wind erosion and measures to control it, e.g., the windbreaks and shelterbelt, are also included. Many examples and problems are included to emphasize the design principles and to facilitate an understanding of the subject matter. Computer models will be described where applicable.

Fundamentals of Crop Physiology

To understand basic principles of plant physiological form and functions as well as processes and its importance in crop production. Plant physiology is a sub discipline of botany concerned with the functioning, or physiology, of plants. Closely related fields include plant morphology (structure of plants), plant ecology (interactions with the environment), phytochemistry (biochemistry of plants), cell biology, genetics, biophysics and molecular biology.

Fundamental processes such as photosynthesis, respiration, plant nutrition, plant hormone functions, tropisms, nastic movements, photo periodism, photo morphogenesis, circadian rhythms, environmental stress physiology, seed germination, dormancy and stomata function and transpiration, both parts of plant water relations, are studied by plant physiologists.

Fundamentals of Agricultural Economics

The course contains a comprehensive treatment of the traditional agricultural production economics topics employing both detailed graphics and differential calculus. The text focuses on the neoclassical factor-product, factor-factor and product-product models, and is suitable for an advanced undergraduate or a beginning graduate-level course in static production economics. Chapters also deal with linear programming, risk and uncertainty and inter temporal resource allocation.

Fundamentals of Plant Pathology

Plant Pathology, also known as Phytopathology is a branch of agricultural, biological or botanical science which deals with the study of diseases in plants - their causes, etiology, epidemiology, resulting losses and management. Plant pathology is related to many other sciences such as virology, mycology, bacteriology, microbiology, physiology, chemistry, genetics, biotechnology etc., all of which provide the knowledge required for the correct diagnosis and management of plant diseases.

Objectives of Plant Pathology :

- To study living, non-living and environmental causes of diseases or disorders of the plants.
- To study the mechanism of plant disease development.
- To study interaction between host/susceptible and the pathogens.
- To develop systems of management of plant diseases and reducing losses caused by them.

Fundamentals of Entomology

- In the course study about-
- The term entomology is derived from two Greek words. Entomon means an insect and logos means to study. The term 'insect' is derived from the Latin word insectum which means 'cut into'.
- Insects came into earth 480 million years ago. Man came to mother earth only one million years ago. Out of 17 lakh living species on earth, 9.5 lakh species are insects, 2.5 lakh species are plants and 0.45 lakh species alone are vertebrates.
- Insects are harmful to man as pests of cultivated crops, animals, stored products, carries of human diseases and pests of household and industrial articles. They are also helpful as producers of honey, lac, silk, dyes, etc., pollinators of crops and as natural enemies of crop pests. They also serve as important link in the food-web of biological cycle in ecosystem.

Fundamentals of Agricultural Extension Education

The term extension was first used in the United States of America in the first decade of this century to connote the extension of knowledge from the Land Grant Colleges to the farmers through the process of informal education. In India, the terms community development & extension education became more popular with the launching of Community Development Projects in 1952 & with the establishment of the National Extension Service in 1953. Since then, Community development has been regarded as a programme for an all-round development of the rural people, & extension education as the means to achieve this objective.

Extension education is an applied behavioural science, the knowledge of which is applied to bring about desirable changes in the behavioural complex of human beings usually through various strategies & programmes of change & by applying the latest scientific & technological innovations.

Communication Skills and Personality Development

Personality refers to an individual's characteristics, style, behavior, mindset, attitude, his own unique way of perceiving things and seeing the world. Genetic factors, family backgrounds, varied cultures, environment, current situations play an imperative role in shaping one's personality. The way you behave with others reflects your personality. An individual with a pleasing personality is appreciated and respected by all.

Effective Communication skills play a crucial role in honing one's personality. **Communication helps individuals to express themselves in the most convincing way.** Your thoughts, feelings and knowledge should be passed on in the most desirable manner and effective communication skills help you in the same.

III Semester

Crop Production Technology – I (*Kharif Crops*)

In the course study about origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals: Rice, Maize, Sorghum, Pearl millet, Wheat, Pulses: Pigeon pea, Green gram, Black gram, Chick pea and Cluster bean, Oilseeds: Groundnut, Castor, Sesame, Rapeseed, Mustard, Sunflower and Soybean; Fiber crop: Cotton; Sugar crop: Sugarcane; Forage crops: Sorghum, Cowpea and Napier hybrid and Fodder maize; Cash crop: Tobacco, Green manure Crops: Sunhemp and Dhaincha.

Fundamentals of Plant Breeding

Plant breeding is the science of changing the traits of plants in order to produce desired characteristics. It has been used to improve the quality of nutrition in products for humans and animals. Plant breeding can be accomplished through many different techniques ranging from

simply selecting plants with desirable characteristics for propagation, to methods that make use of knowledge of genetics and chromosomes, to more complex molecular techniques (see cultigen and cultivar). Genes in a plant are what determine what type of qualitative or quantitative traits it will have. Plant breeders strive to create a specific outcome of plants and potentially new plant varieties.

If the genetic engineer is successful in obtaining a transgenic plant that expresses the gene and passes it on to subsequent progeny in a normal, predictable fashion, s/he still does not have a product for the farmer. The event must be moved into an elite agronomic background.

Agriculture Finance and Co-operation

In the course we study about Agricultural finance: nature and scope, Time value of money, Agricultural credit-meaning, definition, need and classification, Credit analysis, History of financing agriculture in India, Commercial banks, Regional rural banks, Higher financing institutions, Crop insurance, Crop insurance, Agricultural cooperation-philosophy and principles. History of Indian co-operative movement, pre-independence and post independence periods, cooperation in different plan periods, cooperative credit structure-PACS, FSCS, Reorganization of cooperative credit structure in Andhra Pradesh and single window system, Successful cooperative systems in Gujarat, Maharashtra, Punjab.

Agriculture Informatics

Today, advances in technology have shaped a society where data, whether wanted or unwanted, is collected and disseminated in droves. And the world of agriculture is no exception. In a recent post, Big Data in the World of Precision Agriculture, we discussed the benefits and the complexity that mass amounts of data can create for growers in their day-to-day operations. Volume, velocity and variety compose the basic structure of the theoretical makeup of big data. Although volume and velocity resonate throughout agricultural day-to-day operations, the variety of data available to growers wishing to maximize yields while decreasing inputs is growing exponentially.

Farm Machinery and Power

Agricultural machinery is machinery used in farming or other agriculture. There are many types of such equipment, from hand tools and power tools to tractors and the countless kinds of

farm implements that they tow or operate. Diverse arrays of equipment are used in both organic and nonorganic farming. Especially since the advent of mechanized agriculture, agricultural machinery is an indispensable part of how the world is fed.

Production Technology for Vegetables and Spices

India is the seventh largest country in the world with a total geographical area of 328.73 m ha and has second largest population 121crores (2011), after China. The total arable land available is 144 million hectare of which 70% is under rainfed cultivation. Around 55-60 % of the total population depends on agriculture and allied activities. Horticulture crops constitute a significant portion of total agricultural production in the country. In ancient days the gardens had protected enclosures with high walls or similar structures surrounding the houses. The enclosed places were used to grow fruit, vegetables, flowers and ornamental plants. Therefore, in original sense "Horticulture refers to cultivation of garden plants within protected enclosures".

Environmental Studies and Disaster Management

Upon completion of this course, students will acquire knowledge about Understand the natural environment and its relationships with human activities. Characterize and analyze human impacts on the environment. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems. Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels. Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios.

Statistical Methods

Statistics is a branch of mathematics dealing with the collection, organization, analysis, interpretation and presentation of data. In applying statistics to, for example, a scientific, industrial, or social problem, it is conventional to begin with a statistical population or a statistical model process to be studied. Populations can be diverse topics such as "all people living in a country" or "every atom composing a crystal". Statistics deals with all aspects of data including the planning of data collection in terms of the design of surveys and experiments.

Livestock and Poultry Management

Livestock are domesticated animals raised in an agricultural setting to produce labor and commodities such as meat, eggs, milk, fur, leather, and wool. The term is sometimes used to refer solely to those that are bred for consumption, while other times it refers only to farmed ruminants, such as cattle and goats. Livestock management requires strong business sense and a firm understanding of how farms and ranches operate. If you enjoy working with animals and leading people, you might find a rewarding career in this field.

IV Semester

Crop Production Technology –II (*Rabi Crops*)

To know the Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops .

Identify weeds in rabi season crops, Pulses-chickpea, lentil, peas; oilseeds-rape seed, mustard and sunflower; sugar crops-sugarcane, Medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

Production Technology for Ornamental Crops, MAP and Landscaping

In the course discourse about Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production of important vegetable and spices.

Renewable Energy and Green Technology

Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.^[2] Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services. Technologies promote sustainable energy including renewable energy sources, such as hydroelectricity, solar energy, wind energy, wave power, geothermal energy, bioenergy, tidal power and also technologies designed to improve energy efficiency. Costs have decreased immensely throughout the years, and continue to fall. Increasingly, effective government policies support investor confidence and these markets are expanding.

Problematic Soils and their Management

The distinguishing characteristic of saline soils from the agricultural standpoint, is that they contain sufficient neutral soluble salts to adversely affect the growth of most crop plants. For purposes of definition, saline soils are those which have an electrical conductivity of the saturation soil extract of more than 4 dS/m at 25°C (Richards 1954). This value is generally used the world over although the terminology committee of the Soil Science Society of America has lowered the boundary between saline and non-saline soils to 2 dS/m in the saturation extract. Soluble salts most commonly present are the chlorides and sulphates of sodium, calcium and magnesium. Nitrates may be present in appreciable quantities only rarely. Sodium and chloride are by far the most dominant ions, particularly in highly saline soils, although calcium and magnesium are usually present in sufficient quantities to meet the nutritional needs of crops. Many saline soils contain appreciable quantities of gypsum ($\text{CaSO}_4, 2\text{H}_2\text{O}$) in the profile. Soluble carbonates are always absent. The pH value of the saturated soil paste is always less than 8.2 and more often near neutrality.

Production Technology for Fruit and Plantation Crops

Cultivation of fruit crops plays an important role in the prosperity of any nation. It is generally stated that the standard of living of the people can be judged by per capita production and consumption of fruits. Fruits crops are capable of giving higher tonnage of yield per unit area than other field crops. For example, a wheat crop produces on an average 12-15 tonnes from an area of one hectare in two crops per year. Even a hybrid rice variety can give only a maximum of 24 tonnes from one hectare land in three crops per year while a banana crop can yield 35-40 tonnes per hectare. Fruits are found to be a rich source of vitamins and minerals. For example mango, papaya and jack have the important constituent the beta carotene which is actually the precursor of vitamin A.

Principles of Seed Technology

In the course study about flowering Processes in Plants. Seed Formation and Development. The Chemistry of Seeds. Seed Ecology. Seed Germination. Seed Viability and Viability Testing. Seed Dormancy. Seed Vigor and Vigor Testing. Seed Storage and Deterioration. Seed Production. Seed Conditioning and Handling. Seed Drying. Seed Enhancements. Seed Certification. Seed Testing. Seed Pathology and Pathological Testing. Seed Marketing. Seed Legislation and Law Enforcement. The introduced of quality seed of new varieties and combined with other inputs significantly increased yield level e.g. in cereals, yield increased up to 112%, in potato – 24% & sugar beet - 142% in U. S. A. & central Europe. In India the cultivation of high

yielding varieties have helped to increase food production from 52 million tones (1947) to nearly 200 million tones in 2000-2001

Farming System & Sustainable Agriculture

The Indian economy is predominantly rural and agriculture oriented. In agriculture, 85% of the holdings are less than two hectares and the declining trend in the average size of the farmer holdings, poses a serious problem. Majority of them are dry lands, which depend on erratic monsoon rains. The rest of the area is cultivated with supplemental irrigation. The farmers concentrate mainly on crop production, which is invariably subjected to a high degree of uncertainly income and employment. In India the cultivable land is 143.8 million hectares and there is very little possibility of extending it further. Therefore, to meet the requirement of food grains for increasing population, the only option open is through time and effective space utilization in agriculture. The time concept relates to increasing the intensity of cropping under assured irrigated conditions, whereas space utilization pertains to building up of vertical dimension through multi-tier cropping and farming system approach.

Agricultural Marketing Trade & Prices

Agricultural marketing is inferred to cover the services involved in moving an agricultural product from the farm to the consumer. It is also the planning, organizing, directing and handling of agricultural produce in such a way as to satisfy the farmer, producer and the consumer. Numerous interconnected activities are involved in doing this, such as planning production, growing and harvesting, grading, packing and packaging, transport, storage, agro- and food processing, distribution, advertising and sale. Effectively, the term encompasses the entire range of supply chain operations. However, its key function is to help direct these services, by providing competent and able market information, thereby linking the other operations into an integrated service with targeted outcomes.

Introductory Agro-meteorology & Climate Change

Objectives of this course

- To introduce agrometeorology (definitions, aims, scope and importance)
- to understand roles of agrometeorology in agriculture and its relation to other areas of agriculture
- to acquaint with recent developments in agrometeorology with historical development of climate change.

- Agrometeorology or Agricultural meteorology studies meteorological and hydrological factors in relation to agriculture. Agrometeorology studies the behaviour of the weather elements that have direct relevance to agriculture and their effect on crop production.
- Weather and climate are the factors determining the success or failure of agriculture.

V Semester

Principles of Integrated Pest and Disease Management

Integrated pest management (IPM), also known as integrated pest control (IPC) is a broad-based approach that integrates practices for economic control of pests. IPM aims to suppress pest populations below the economic injury level (EIL). The UN's Food and Agriculture Organization defines IPM as "the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

Manures, Fertilizers and Soil Fertility Management

Plant requires food/nutrients/elements for its growth and development which are absorbed through soil. The nutrient supplying sources are manures and fertilizers. Application of manures and fertilizers to the soil is one of the important factors which help in increasing the crop yield and to maintain the soil fertility. N, P and K are the 3 major elements required for the crop growth.

Manure: It is a well decomposed refuse from the stable and barn yards including both animal excreta and straw or other litter. The term manure implies to the any material with the exception

of water which when added to the soil makes it productive and promotes plant growth.

Fertilizers: These are industrially manufactured chemicals containing plant nutrients. It is an artificial product containing the plant nutrients which when added to soil makes it productive and promotes plant growth.

Pests of Crops and Stored Grain and their Management

It has been estimated that between one quarter and one third of the world grain crop is lost each year during storage. Much of this is due to insect attack. In addition, grain which is not lost is severely reduced in quality by insect damage. Many grain pests preferentially eat out grain embryos, thereby reducing the protein content of feed grain and lowering the percentage of seeds which germinate. Some important stored grain pests include the lesser grain borer, rice weevil and rust red flour beetle.

Preventive method

1. Store the grains in a clean godown
2. Fill cracks, crevices and holes with cement.
3. Use brand new gunny bags. Old gunny bags if used, must be disinfected by dipping in 1 part malathion (Cythion 50 EC) in 500 parts water for 10 minutes and dried in shade before filling the grains.

Diseases of Field and Horticultural Crops and their Management -I

Healthy plants look good, grow well, and are productive. Plants remain healthy as long as conditions favor normal plant growth and development. Sometimes plants are unhealthy, and this occurs when something irritates the plant. The irritation may be somewhat continuous, acting over an extended period, or it may occur nearly instantaneously. Continuous irritation causes disease; instantaneous irritation causes injury.

Disease frequently is expressed by production of symptoms. Some common types of symptoms on specific parts of plants include rotting, stunting or swelling of roots; cankering, rotting, discoloration, distortion, elongation, or stunting of stems; wilting, spotting, blighting, rusting, mottling, discoloration, distortion, or stunting of leaves; and spotting, blighting, stunting, discoloration, distortion, or mottling of fruit.

Common agents that cause plant disease and injury both include nonliving (abiotic) and living (biotic) agents. Nonliving factors that cause disease include harmful levels of temperature, moisture, light, nutrient, pH, air pollutants, and pesticides. Living pathogens that cause disease

include fungi, bacteria, viruses, viroids, mycoplasmas, and nematodes; most pathogens are microscopic and derive their food by growing in or on the host plant.

Crop Improvement-I (*Kharif Crops*)

Crop Improvement; In the course study about crop improvement through various techniques-

1. Integrated Gene Management (Augmentation, Evaluation, Conservation and Utilization)
2. Identification of resistant/tolerant donors with high yield potential against major insect-pests and pathogens and their utilization
3. Allele mining and discovery of new genes for productivity and resistance/tolerance to biotic/abiotic stresses to exploit in breeding programmes
4. Widening of gene-pools through intra/inter-specific hybridization and genetic enhancement (Pre-breeding)
 - a) Spot blotch disease of wheat
 - b) Sclerotinia Rot and Alternaria blight of rapeseed and mustard
 - c) Sterility mosaic virus of any field crops
 - d) Heat, drought tolerance of wheat, maize, vegetables, etc
5. Breeding for high yielding varieties/hybrids: Tolerant/resistant to wide range of biotic/abiotic stresses through pyramiding of genes using conventional and molecular tools

Entrepreneurship Development and Business Communication

Entrepreneurship is an important aspect of the business and industrial growth of a modern nation. The spirit of entrepreneurship is marked by enthusiasm, persistence and ability to seek opportunities. It is at the core of all commercial and industrial activity. One need not have a business and financial background in order to be a successful entrepreneur. But an entrepreneur must have the ability to assume risk and take opportunities for profit and advantage. The best way to minimize the risk is to prepare one self for the road that lies ahead. Although everyone may not be an entrepreneur at heart, it is possible to acquire most of the skills and abilities which are necessary for success in business. The business climate of our country is fast improving and many individuals and families are venturing into enterprises, small and big. Knowledge and understanding of entrepreneurship are a necessary part of today's business education. Business Communication is today an integral part of business and management education. Success in business and industry depends largely on a person's ability to build and sustain relationships with different sections of society, customers, suppliers, employees and people at large in and outside the market. Communication skills are all the more important for service industries whose success

depends not only on the quality but also on the manner and the style in which the service is rendered; the human relationship is as important as the quality.

Geoinformatics and Nano-technology for Precision Farming

This course "Geoinformatics and Nanotechnology for Precision Farming" deals with geoinformatics and its application in precision farming besides importance of nanotechnology for efficient use of inputs including fertilisers, plant protection chemicals and herbicides in crop production as per the syllabus prescribed by the Fifth Deans' Committee on Higher Agricultural Educations in India from the academic year 2016-17.

Precision agriculture is a site specific crop management approach in view of utilizing the fullest resources at required level. Thus reducing the input cost, causing no sound damage to the environment and also attributing better market to the farm produces.

Scientific approach is required right from land preparation, seed or sapling selection, soil nutrient requirement assessment, irrigation management, fertilizer recommendation and application (root zone application or through fertigation), re-utilization of farm residues, pesticide or herbicide spray, biological control measures adoption, marketing (sorting, grading & pricing), analyzing the need of post-harvest technology implementation (for perishables and export goods) and value addition (in case of reduced demand period).Majority of the farmers with limited awareness on the scientific approaches and practices.

Practical Crop Production – I (*Kharif* crops)

In the course study about selection of nursery area - Preparation of nursery - Application of manures to nursery - seed treatment with fungicide and bio-fertilizers - seed soaking and incubation - forming nursery beds and sowing seeds - weed control and plant protection to nursery - preparation of main field - application of organic manures - basal application of fertilizers and bio-fertilizers - pulling out seedlings and transplanting - application of herbicides - after cultivation practices - top dressing of fertilizers, plant protection measures - harvesting, threshing, drying and cleaning the produce - working out cost of cultivation and economics. If direct sown crop: Selection of main field - Preparation of main field - land configuration for sowing - application of manures and fertilizers - seed treatment with fungicide and biofertilizers - sowing and irrigation - application of herbicides - after cultivation practices - top dressing of fertilizers, plant protection measures - harvesting, threshing, drying and cleaning the produce - working out cost of cultivation and economics.

Intellectual Property Rights

Intellectual property (IP) is a category of property that includes intangible creations of the human intellect, and primarily encompasses copyrights, patents, and trademarks.^[1] It also includes other types of rights, such as trade secrets, publicity rights, moral rights, and rights against unfair competition. Artistic works like music and literature, as well as some discoveries, inventions, words, phrases, symbols, and designs, can all be protected as intellectual property.^{[2][3]} It was not until the 19th century that the term "intellectual property" began to be used, and not until the late 20th century that it became commonplace in the majority of the world.^[4]

The main purpose of intellectual property law is to encourage the creation of a large variety of intellectual goods. To achieve this, the law gives people and businesses property rights to the information and intellectual goods they create – usually for a limited period of time. This gives economic incentive for their creation, because it allows people to profit from the information and intellectual goods they create.^[5] These economic incentives are expected to stimulate innovation and contribute to the technological progress of countries, which depends on the extent of protection granted to innovators.

VI Semester

Rainfed Agriculture & Watershed Management

The term **Rainfed agriculture** is used to describe farming practices that rely on rainfall for water. It provides much of the food consumed by poor communities in developing countries. For example, rainfed agriculture accounts for more than 95% of farmed land in sub-Saharan Africa, 90% in Latin America, 75% in the Near East and North Africa; 65% in East Asia and 60% in South Asia.^[1]

Levels of productivity, particularly in parts of sub-Saharan Africa and South Asia, are low due to degraded soils, high levels of evaporation, droughts, floods and a general lack of effective water management. A major study into water use by agriculture, known as the Comprehensive Assessment of Water Management in Agriculture, coordinated by the International Water Management Institute, noted a close correlation between hunger, poverty and water. However, it concluded that there was much opportunity to raise productivity from rainfed farming.

Protected Cultivation and Secondary Agriculture

Protected cultivation offers several advantages to produce vegetables, flowers and planting material of high quality and yields, thus using the land and other resources more efficiently. This becomes more relevant to small and marginal growers who have small land holding and would

be interested in a technology, which helps them to produce more crops each year from their land, particularly during off-season when prices are higher. The protected cultivation technology in the country had started to make a dent around one decade back and the area under protected cultivation increased sharply in the wake of several government initiatives and schemes such as National Horticulture Mission, Technology Missions, NATP etc. largely in the form of introduction of technology. However, in spite of large increase in area, the availability of greenhouse structures suitable to agro climatic conditions of the country, their economic viability, production technology, management of diseases and pests and post harvest losses including value addition etc remained as one of the few researchable issues though the training of large number of human resources had concomitantly been addressed by NHM etc. in most of the states. In the wake of such challenges, the production technology, farm inputs, post harvest losses, value addition and marketing remained largely unaddressed.

Diseases of Field and Horticultural Crops and their Management-II

In the course study about economic Importance, symptoms, cause, disease cycle and management of diseases of: citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, apple, chilli, brinjal, bhendi, potato, crucifers, cucurbits, tomato, beans, onion, coconut, oil palm, betel vine, mulberry, coffee, tea, rose, chrysanthemum, jasmine and crossandra.

Post-harvest Management and Value Addition of Fruits and Vegetables

Dryland Horticulture and Agri-Horticultural systems as an alternate land use system have gained much importance in recent years, as the fruit crops are highly remunerative for replacing subsistence farming and thus alleviate poverty level in rainfed, dryland, hilly and arid ecosystems. These crops have potential for development of wastelands through planned strategies, need comparatively less water than food crops, provide higher employment opportunity and environment-friendly. Fruits are undoubtedly very important for nutrition security with high potential of value addition and foreign exchange earnings.

A comprehensive nation-wide quantitative assessment of harvest and post-harvest losses for 46 agricultural produces was carried out to estimate the extent of harvest and post-harvest losses.

Processing is the best way of utilizing surplus production of fruits during seasonal gluts. Advantages of processing: • Helps in converting perishable fruits in to durable form • Fruits, which are very difficult to eat out of hand can be processed in to a range of highly acceptable fruit product. • Helps in reducing wastage. • Value addition.

Management of Beneficial Insects

Beneficial insects (sometimes called beneficial bugs) are any of a number of species of insects that perform valued services like pollination and pest control. The concept

of *beneficial* is subjective and only arises in light of desired outcomes from a human perspective. In farming and agriculture, where the goal is to raise selected crops, insects that hinder the production process are classified as pests, while insects that assist production are considered beneficial. In horticulture and gardening; pest control, habitat integration, and 'natural vitality' aesthetics are the desired outcome with beneficial insects.

Encouraging beneficial insects, by providing suitable living conditions, is a pest control strategy, often used in organic farming, organic gardening or integrated pest management. Companies specializing in biological pest control sell many types of beneficial insects, particularly for use in enclosed areas, like greenhouses.

Some species of bee are beneficial as pollinators, although generally only efficient at pollinating plants from the same area of origin, facilitating propagation and fruit production for many plants. Also, some bees are predatory or parasitic, killing pest insects. This group includes not only honeybees, but also many other kinds that are more efficient at pollinating. Bees can be attracted by many companion plants, especially bee balm and pineapple sage for honeybees, or Apiaceae like Queen Anne's lace and parsley, for predatory bees.

Ladybirds are generally thought of as beneficial because they eat large quantities of aphids, mites and other arthropods that feed on various plants.

Crop Improvement-II (*Rabi crops*)

Crop Improvement

1. Integrated Gene Management (Augmentation, Evaluation, Conservation and Utilization)
2. Identification of resistant/tolerant donors with high yield potential against major insect-pests and pathogens and their utilization
3. Allele mining and discovery of new genes for productivity and resistance/tolerance to biotic/a biotic stresses to exploit in breeding programmes
4. Widening of gene-pools through intra/inter-specific hybridization and genetic enhancement (Pre-breeding)
 - a) Spot blotch disease of wheat
 - b) Sclerotinia Rot and alter aria blight of rapeseed and mustard
 - c) Sterility mosaic virus of any field crops
 - d) Heat, drought tolerance of wheat, maize, vegetables, etc
5. Breeding for high yielding varieties/hybrids: Tolerant/resistant to wide range of biotic/a biotic stresses through pyramiding of genes using conventional and molecular tools
6. Identification and mapping of the QTL associated with yield tolerance/resistance and quality in different crops and their introgression
7. Genomics, transcriptomics and proteomics analysis of the crops for biotic/a biotic stresses.
8. Genomic analysis of the plant pathogen and diversity available in Bihar

9. Identification of genotypes with better nutrient uptake ability and efficient utilization (Input use Efficiency)
10. Clonal selection of fruit crops for improving plant type

Practical Crop Production –II (*Rabi* crops)

In the study about selection of nursery area - Preparation of nursery - Application of manures to nursery - seed treatment with fungicide and bio-fertilizers - seed soaking and incubation - forming nursery beds and sowing seeds - weed control and plant protection to nursery - preparation of main field - application of organic manures - basal application of fertilizers and bio-fertilizers - pulling out seedlings and transplanting - application of herbicides - after cultivation practices - top dressing of fertilizers, plant protection measures - harvesting, threshing, drying and cleaning the produce - working out cost of cultivation and economics. If direct sown crop: Selection of main field - Preparation of main field - land configuration for sowing - application of manures and fertilizers - seed treatment with fungicide and biofertilizers - sowing and irrigation - application of herbicides - after cultivation practices - top dressing of fertilizers, plant protection measures - harvesting, threshing, drying and cleaning the produce - working out cost of cultivation and economics.

Principles of Organic Farming

The Principles of Organic Agriculture were established by the International Federation of Organic Agriculture Movements (IFOAM) in September, 2005. They are aspirations for organic farming. The Principles were approved by the General Assembly of IFOAM on September 25, 2005. The General Assembly of IFOAM approved the Principles of Organic Agriculture on September 28, 2005. The principles were developed during an intensive two-year participatory process. The aim of the principles is both to inspire the organic movement and to describe the purpose of organic agriculture to the wider world.

The organic sector has grown significantly in recent years. Along with that growth have come opportunities and challenges. The IFOAM General Assembly concluded that there was a need to elaborate the basic values of organic agriculture.

The principles are intended to "apply to agriculture in the broadest sense, including the way people tend soils, water, plants and animals in order to produce, prepare and distribute goods. They concern the way people interact with living landscapes, relate to one another and shape the legacy of future generations.

These principles are the roots from which Organic Agriculture grows and develops. They express the contribution that Organic Agriculture can make to the world. Composed as inter-connected

ethical principles to inspire the organic movement -- in its full diversity, they guide our development of positions, programs and standards.

Farm Management, Production & Resource Economics

The process of economic development involves the growth of national output. To achieve an expansion of national output, it is essential to combine natural resources, human resources and capital. (i.e. Land, Labour & Capital). Therefore, to facilitate the process of economic development the existence of favorable natural resources is must. Otherwise it will retard the process of development. However, natural resources only are not sufficient for development but it requires following aspects also.

1. A location of country
2. Accessibility (availability) to raw materials and markets in other countries.
3. The present state of knowledge
4. Growth of technology
5. Attitudes of the people towards material things, saving and investment.

Natural Resources:

- 1) Land
- 2) Water resource
- 3) Marine resource
- 4) Fisheries
- 5) Mineral resource
- 6) Forests
- 7) Climate, rainfall and topography

Principles of Food Science and Nutrition

Principles of Food Science demonstrates how the laws of science are at work in producing, processing, preparing, preserving, and metabolizing food. Students learn how cooking, health, and storage tips connect science basics to daily food encounters. The text covers the basic laws of chemistry, microbiology, and physics as they are applied to food components and complex food systems. Students learn scientific facts and principles that can be applied to a future food science career and as to more-creative, nutritious home cooking. The requirements and opportunities for obtaining a food science career are explored as well as the impact of this career path on local, national, and global economies.

- Numerous lab experiments help students apply basic math and technical writing skills to real-world food problems.
- The value of different types of evaluations—scientific vs. sensory—are examined, with applications to school lab experiments and commercial food product development.

- Lessons emphasize the importance of lab safety, teamwork, attention to detail, and high ethical standards.
- Activities of food scientists include the development of new food products, design of processes to produce these foods, choice of packaging materials, shelf-life studies, sensory evaluation of products using survey panels or potential consumers, as well as microbiological and chemical testing.^[3] Food scientists may study more fundamental phenomena that are directly linked to the production of food products and its properties.
- Food science brings together multiple scientific disciplines. It incorporates concepts from fields such as microbiology, chemical engineering, and biochemistry.

Rural Agricultural Work Experience and Agro-industrial Attachment

(RAWE &AIA)

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 10 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

Evaluation of RAWE Programme

Attendance: Minimum attendance - 85%.

Records: Students would complete the record work/ report writing/ presentations, etc. based on daily field observations recorded in notebooks and weekly diaries maintained by them.

Evaluation Procedure: Students shall be evaluated component-wise under village attachment and agro-industrial attachment. The respective component In-Charge Instructor(s), agro-industrial official and Course Coordinator will evaluate the students as under: