



**K.R. MANGALAM UNIVERSITY**  
**THE COMPLETE WORLD OF EDUCATION**

# **School of Agricultural Sciences**

**Student Handbook  
For  
Agricultural Sciences  
2020-21**

## Index

S.No	Contents	Page No.
1.	Introduction	3
2.	About School	3
3.	Programme offered by the School	4
3.1	B.Sc.(Hons.)Agriculture	4
4.	Programme Duration	5
5	Class Timings	5
6	Syllabi	5
7.	Annexure-A (Elective Subjects)	76
	Annexure-B	77

## **1. Introduction**

The K.R. Mangalam Group has made a name for itself in the field of education. Over a period of time, the various educational entities of the group have converged into a fully functional corporate academy. Resources at KRM have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly inter-disciplinary environment wherein they develop integrative skills through interaction with students from engineering, management, journalism and media study streams.

The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education. With the mushrooming of institutions of Higher Education in the National Capital Region, the University considered it very important that students take informed decisions and pursue career objectives in an institution, where the concept of education has evolved as a natural process.

K.R. Mangalam University was founded in the year 2013 by Mangalam Edu Gate, a company incorporated under Section 25 of the Companies Act, 1956.

### **K. R. Mangalam University is unique because of its**

- i. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.
- ii. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

### **Objectives**

- i. To impart theoretical and practical knowledge about agriculture to undergraduate, post-graduate and Doctoral education .
- ii. To undertake research programmes in identified fields of agriculture with agricultural and industrial interface.
- iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities.
- iv. To act as a nodal centre for transfer of technology to the farmers and industries.
- v. To provide job oriented professional education to the student community with particular focus on Haryana.

## **2. About School (School of Agricultural Sciences)**

School of Agricultural Sciences at K. R. Mangalam University is fully equipped with the facilities of laboratories agriculture farms to carry out the Teaching, Practical and Research work. All the faculty members are well qualified (Ph.D. in their respective fields) and well experienced. The faculty remains in constant touch with various experts in the relevant fields and is willing to experiment with latest ideas in teaching and research.

School of Agricultural Sciences imparts students technical knowledge, enhances their practical skill and ability, motivating them to think creatively, helping them to act independently and take decisions accordingly in all their technical pursuits and other endeavours. It strives to empower its students and faculty members to contribute to the development of society and Nation.

### **3. Programmes offered by the School**

#### **3.1 B.Sc.(Hons.) Agriculture**

B.Sc.(Hons.)Agriculture programme is designed to impart theoretical, practical knowledge and extension work. The hands on experience help to enrich student's skills and competence, as required by the industries and farmers today.

Realizing the potential of Agricultural Technology industry and rising food demands and in lined requirement of trained human resource, the course of B.Sc.(Hons.) Agriculture has been developed. The School of Agricultural Sciences provides knowledge on a wide array of agricultural sciences and its related areas. Students will gain fundamental skills and knowledge in agriculture and related domains. The programme focuses on developing professional capabilities, skills and competence required in the field of agriculture. The Courses are composed of theory classes and practical in labs as well as on agriculture farms. The students are exposed to farmers' fields and attached with the farmers in the villages and agri-based Industries. Labs work, site visits, seminars, workshops and educational tours in different Indian Agriculture Universities along with excursion tours are aimed to develops conceptual and analytical abilities of students as well as giving them practical and real time experience. The students are being trained in Agri- based and entrepreneurial skills like Organic farming, Herbal and Medicinal plant cultivation, Protected cultivation, Bee-keeping, Mushroom cultivation and Value added Fruit and Vegetable Products preparation.

**Eligibility Criteria:** Candidate must have passed 10+2 with 50% marks in PCB/PCM/ Agriculture with English as a compulsory subject from a recognized State or Central Board or Equivalent.

#### **Course Outline**

**Basic Sciences** courses like Basic Mathematics, Elementary Biology, Biochemistry, Microbiology, Genetics, Rural Sociology and Educational Psychology.

**Agriculture courses:** Agronomy, Agro-Meteorology, Crop Physiology, Soil Science, Organic Farming, Entomology, Plant Pathology, Plant Breeding, Horticulture, Vegetables Science, Forestry, Livestock Production and Poultry Management, Agriculture Economics and Extension Education and Labs work in all these respective courses. For specialization twelve elective courses viz Agribusiness Management, Agrochemicals Commercial Plant Breeding, Landscaping, Food Safety and Standards, Bio-Pesticides and Bio-fertilizers, Protected Cultivation, Micro Propagation Technologies, Hi-Tech Horticulture, Weed Management System, Simulation and Agro advisory Agricultural journalism have been kept and out of these the students can opt any of three courses. In addition to this students are attached with the farmers in villages and Agri-based Industries for job oriented practical.

#### **Career Options**

Government Jobs in State Department of Agriculture as Agricultural Development Officer, Agriculture Inspector, Horticulture Development Officer, Soil Conservator, Soil Testing Officer, Plant Protection Inspector, Plant Protection Officer. Plant Protection Quarantines, National Dairy Institutes, and Jobs in finance sector/institutes like Banks and NABARD as Agriculture Assistant, Agriculture Development Officer, Jobs in Corporate sectors as Food Corporation of India, State warehouses, fertilizer companies like IFFCO, NFL, National and State, Seed Companies like National Seed Corporation, Haryana Seed Development Corporation, Central State Farms, Indo –Israeli, Precision Farming projects. • Private Seed Companies like MAHYCO and Pioneer Seed Company Pesticide Companies like BAYER, HIL, SYNGENTA, DOW, CYNAMID INDIA LTD, LUPIN and Biotech International PVT Ltd etc., Self-Entrepreneurships as business in agriculture inputs like Fertilizers, Seed, Pesticides, Mushroom cultivation and high value fruit crop production like Strawberry cultivation, Poultry, Piggery Farms and Organic Farming etc., Jobs in National and International Universities/Institutions after PG as Scientist or Professor, Can Appear in all National and state competitive examinations, To excel in all above

positions, it requires a high level skill and competence in respective field, high standard personal grooming and presentation.

#### **4. Programme Duration**

The minimum period required for the B.Sc.(Hons.) Agriculture Programme offered by the University shall extend over a period of four Academic Years, i.e., 8 semesters. The Programme will be considered completed when the candidate has earned minimum courses and credits required by the Programme curriculum.

#### **5. Class Timings**

The classes will be held from Monday to Friday from 9:10 am to 4:10 pm.

#### **6. Syllabi**

The syllabi of all courses for B.Sc.(Hons.) Agriculture offered by SOHMCT are given in the following pages. For each course, the first line contains; Course Code, Title and Credits (C) of the course. This is followed by the course overview, objectives, syllabus (Theory and Practical), suggested readings (Text Book and Reference Books etc.)

## BACHELOR OF SCIENCE (HONS.) AGRICULTURE

### FIRST SEMESTER (Ist Year)

SAAG101A	Principles of Agricultural Meteorology	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge on weather parameters and climate conditions. This subject emphasizes the non-living climatic and weather factors important from agriculture point of view. This course will help in making the weather predictions which help in better crop production.

#### Objective and Expected Outcome

1. To study the agricultural meteorological aspects.
  2. To study the environmental factors responsible for agriculture production
  3. To study the climatic disasters and their management in better crop growth.
  4. To study the rain precipitation, soil radiations and global warming.
  5. To make prediction for future climatic and weather conditions related to crop growth and crop pests and diseases outbreaks
- The students will learn from this course about the best climatic conditions and forecasting the favourable and unfavorable conditions for healthy agriculture.

#### Theory:

##### Unit -1

- Definition and importance of agricultural meteorology, meaning and scope and relevance of agricultural meteorology atmosphere-
- Its composition, extent and structure, atmospheric pressure, daily and seasonal variation of wind speed and direction,
- Cyclones, anticyclones and air masses
- Nature and properties of solar radiation, solar constant, depletion of solar radiation,

##### Unit -2

- Short wave and thermal radiation, net radiation, albedo
- Atmospheric temperature, daily and seasonal variations of temperature
- Heat balance of earth and global warming
- Atmospheric humidity, concept of saturation, vapour pressure

##### Unit -3

- Process of condensation, formation of dew, fog, mist, frost, snow, rain and hail, precipitation
- Cloud formation and movement, evaporation and evapotranspiration
- Agriculture and weather relations, Introduction to monsoon
- Impact of climate on crop production, livestock,

##### Unit -4

- Agro-climatic requirements of major crops of Haryana (rice, wheat,
- Pearl millet, sorghum, mustard and cotton
- Crop microclimate and its modification, Basics of medium and long range weather forecasting,
- Agroclimatic zones of Haryana and India, concept of climate change and air pollution, smog
- Introduction to remote sensing and GIS

#### Practical:

Agro-meteorological observatory – its site selection, installation and exposure to instruments, weather data recording; measurement of total solar radiation, short wave and long wave radiation, albedo and sunshine duration; Maximum and minimum ambient temperature, soil temperature, dew point

temperature; Determination of vapour pressure, relative humidity, atmospheric pressure, wind speed and wind direction; Measurement of rain, open pan evaporation and evapo-transpiration, Processing, tabulation and presentation of weather data.

**Suggested Readings**

Khadekar, S.R. 2001. Meteorology. Agromet publishers, Nagpur

Varshneya, M.C. and Balakrishna Pillai, B. 2003. Textbook of Agricultural Meteorology. ICAR, New Delhi.

Prasada Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Second Edition. Kerala Agricultural University, Thrissur

<b>SACS102A</b>	<b>Information Technology Fundamentals/Introduction to computers &amp; IT Automatiom</b>	<b>Credits: 04(4+0)</b>
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**Overview:**

This subject appries the students about the role of digitization and information technology in agriculture. World Wide Web (WWW), concepts and components, e-Agriculture, concepts and applications, IT application for computation. Geo-spatial technology for generating valuable agri-information, farm decisions. Preparation of contingent crop-planning using IT tools are taught in this subject.

**Objective and Expected Outcome**

1. To study about the computer and its operative systems.
2. To study the World Wide Web (WWW): Concepts and components
3. To study the e-Agriculture, concepts and applications
4. To study the IT application for computation
5. To study the Apps in Agriculture for farm advises, market price, post-harvest management *etc.*

After studying this subject the students will be able to understand the role of information Technology like app. in agriculture and e-agriculture in agriculture field.

**Theory**

**Unit –1**

- 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

**Unit-2**

- World Wide Web (WWW): Concepts and components.
- 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-3**

- 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.*

**Unit-4**

- Geospatial technology for generating valuable agri-information.
- 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.

**Suggested Readings:**

Sharma K.V.S. 2001. Statistics made simple: Do it yourself on PC. Prentice Hall of India.
Capron.H.L. 1996. Computers – Tools for an information age – Fourth Edition. The Benjamin / Cummings Publishing Company, Inc., New York.
Peter Nortons. 2001. Introduction to Computers – Fourth Edition. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
P.K. Sinha 2009. Computer Fundamentals-Third Edition. BPB publication

<b>SAAG103A</b>	<b>Introductory Agriculture</b>	<b>Credits:01(1+0)</b>
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**Overview:**

This subject deals with the ancient and heritage of agriculture. The concepts of agriculture, agriculture business, factors responsible crop growths, environment, ecology and ecosystem, economic ecology; aspects of food chain and energy flow are taught. This subject enriches the students about the need and importance of value addition in agriculture and multifaceted roles and tasks of women in agriculture.

**Objective and Expected Outcome**

1. To study the heritage and ancient history and importance of agriculture.
2. To study the fundamentals, concepts of agriculture.
3. To study the factors affecting crop production, Indian agriculture balance sheet, contrasting trends in agriculture growth.
4. To study the environment, ecology and ecosystem.
5. To study the multifaceted roles and tasks of women in agriculture,

The students will be benefitted with the knowledge of history, concept, importance, crop ecology and women in agriculture.

**Theory:**

**Unit -1**

- Definition and importance of agriculture, Meaning and scope of agriculture,
- Plant growth and development– concept and differences, general growth curves
- Elements affecting crop production, classification of crops

**Unit -2**

- Art, science and business of crop production;
- Agricultural heritage, chronological agricultural technology development in India,
- Ancient Indian agriculture in civilization era, conversion of man from food gatherer to food producer,
- Development of agriculture, chronological agricultural development in India.

**Unit -3**

- Factors affecting crop production, Indian agriculture balance sheet, contrasting trends in agriculture growth,
- Aspects of food chain and energy flow, soil physiographic and diversity
- Aquaculture, water resources of Haryana and India.

**Unit -4**

- Environment, ecology and ecosystem, economic ecology
- Classification of agriculture on the basis of irrigation (Rainfall), cropping and farming system
- Need and importance of value addition in agriculture, requirement of new technology
- Women in agriculture, multifaceted roles and tasks, work stress factors, nutritional and rural standards, drudgery reduction for farm women, women friendly technology, empowerment of women, role and impact of extension and training of farm women.

### Suggested Readings:

Ahmed, S. 2004. Gender Issues in Agricultural and Rural Livelihoods-Vol. I M.S. Swaminathan Research Foundation, Chennai and Kerala Agricultural University, Thrissur.
Commonwealth Secretariat.1996. Women and Natural Resource Management: A Manual for the Asian Region. Gender and Youth Affairs Division, London.
FAO [Food and Agriculture Organization of the United Nations]. 2001. Field Level Handbook, SEAGA Socio-Economic and Gender Analysis Programme. FAO, Rome (Available: <a href="http://www.fao.org/sd/seaga/downloads/En/fieldEn.pdf">http://www.fao.org/sd/seaga/downloads/En/fieldEn.pdf</a> ).
Husain, M. 1996. Systematic Agricultural Geography. Rawat Publications, Jaipur
Noor Mohammed.1992. Origin, diffusion and development of agriculture. In: Noor Mohammed (ed.), New Dimensions in Agricultural Geography: Vol.1.Historical Dimensions of Agriculture. Concept Publishing Co., New Delhi. Pp29-75.

SAAG105A	Insect Morphology and Systematics	Credits:04 (3+1)
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**Overview:**

This subject is designed to impart fundamental knowledge on the morphological characters of insect, the modifications of antennae, legs, wings and mouth parts, digestive, reproductive, other systems and classification of insects in various orders.

The subject will provide the fundamental knowledge about the insect which ultimately help the students in knowing the economic importance of insects.

**Objective and Expected Outcome**

1. To study the dominance of insects on earth.
2. To study the economic importance of insects.
3. To study the external morphology and systems of insects.
4. To study the insect systematic and classification.

After studying this course the students will be able know about the morphology, impotance and identification of insects which is essential from agricultural point of view.

**Theory:**

**Unit 1**

- Introduction to entomology and insects and their importance
- History of Indian entomology, Factors responsible for insect abundance on earth important characters of phylum arthropoda and its major classes with special reference to class hexapoda (Insecta).
- Insect Morphology: Insect integument its structure and functions, molting process, insect body regions, cockroach/grasshopper

**Unit- 2**

- Structure of head its sclerites and sutures, types and modifications of insect antennae, mouthparts and sense organs.
- Thorax - types of wings, wing venation, wing coupling apparatus, legs with their modifications, abdominal segments ,
- Introduction to metamorphosis, diapause, types of larvae and pupae in insects. Structure and functions of digestive, circulatory, respiratory, nervous and reproductive systems in insects (cockroach/grasshopper), introduction to types of reproduction and

**Unit- 3**

- **Systematics** –Definitions of taxonomy, binomial nomenclature, species, biotype, genus, family, order; insect hierarchy and classification of insects up to orders and important families of agricultural importance
- distinguishing characters; Thysanura, Diplura, Protura, Collembola, Ephimeroptera, Odonata, Plecoptera, Grylloblattodea, Phasmida, Dermeptera, Embioptera,
- Orthoptera (Families: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae, Schizodactylidae); Dictyoptera (Blattidae and Mantidae,); Zoraptera, Psocoptera, Mallophaga, Siphunculata, Isoptera (F:Termitidae);

**Unit -4**

- Thysanoptera (F:Thripidae); Hemiptera (Sub Order Homoptera and Heteroptera)-(Families: Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Lophopidae, Lacciferidae, Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygidae, Pyrrhocoridae, Coreidae, Belastomatidae); Neuroptera (Chrysopidae); Lepidoptera (F: Noctuidae, Sphingidae, Pyralidae,

Gelechiidae, Arctiidae, Pieridae, Danaidae, Papilionidae, Yponomeutidae (Plutellidae), Hesperidae, Coccidaeidae, Pterophoridae, Saturnidae, Bombycidae, Epipyropidae, Lycinidae, Pieridae, Papilionidae, Hesperidae);

- Coleoptera (F: Coccinellidae, Chrysomelidae, Cerambycidae, Bruchidae, Scarabaeidae, Carabidae, Dermestidae, Tenebrionidae, Anobiidae, Meloidae, Bostrychidae, Lampyridae, Curculionidae.);
- Strepsitera, Mecoptera, Siphonaptera, Trichoptera,
- Hymenoptera (F: Tenthredinidae, Formicidae, Vespidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Encyrtidae, Aphelinidae, Chalcididae, Xylophidae, Megachilidae);
- Diptera (Cecidomyiidae, Tachinidae, Agromyzidae, Tephritidae, Syrphidae, Muscidae, Culicidae, Tabanidae, Phoridae, Drosophilidae, Anthomyiidae, Glossinidae, Hippoboscidae, Asilidae, Psilidae).

### Practical:

Methods of collection and preservation of insects including immature stages; external features of grasshopper/cockroach; Identification of 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, reproductive systems (Cockroach/Grasshopper); study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and agriculturally important families.

**Note:** Students should submit sufficient insect specimens representing different orders and families before the practical examination.

### Suggested Readings:

Chapman, R.F. 1988. <i>Insects: Structure and Function</i> . Cambridge Univ. Press, UK.
Mani, M. S. 1968. <i>General Entomology</i> . Oxford and IBH Publishing Company, New Delhi. 912 p.
Richards, O.W. and Davies, R. G. 1977. <i>Imm's General Text Book of Entomology</i> , Vol.1 and 2, Chapman and Hill Publication, London, 1345p.
Srivastava, P. D. and Singh, R. P. 1997. <i>An Introduction to Entomology</i> , Concept Publishing Company, New Delhi, 269p
Charles A Triplehorn and Norman F. Johnson 2005 <i>Borrer and De Long's Introduction to the Study of Insects</i> Thomson Brooks/Cole Publishing. U.S.A.
Atwal, A. S and Bains, S. S. 1989. <i>Applied Animal Ecology</i> . Kalyani Publishers. New Delhi. 245p
Snodgrass, R.E. 2001. <i>Principles of Insect Morphology</i> . CBS Publishers & Distributors, Delhi.
David, B.V. and Kumaraswami, T. 1996 <i>Elements of Economic Entomology</i> . Popular Book Depot, Madras. 536 p.
Dhaliwal, G. S. and Ramesh Arora. 1998. <i>Principles of Insect Pest Management</i> . Kalyani Publishers, New Delhi. 297 p.

<b>SAAG109A</b>	<b>Introduction to Soil Science</b>	<b>Credits:3(2+1)</b>
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**Overview:**

This subject is very important from agricultural point of view, student learn about soil, formation, pedology, Composition of soil; Taxonomic classification of soils, Soil physical properties, soil compaction, Soil air and gaseous exchange, soil , Properties, nature, types and significance, Soil organisms and their significance.

**Objective and Expected Outcome**

1. To study the Soil: Pedological concepts, Origin of the earth.
2. To study soil formation, factors affecting soil formation
3. To study Taxonomy of soil, Soil physical properties their significance in agriculture.
4. Soil organisms and their significance.

The student will be enriched with the knowledge of soil, its properties and soil microorganisms.

**Theory:**

**Unit 1**

- Soil: Pedological and edaphological concepts, Origin of the earth, Earth's crust;
- Composition of soil; Soil forming rocks and minerals, Soil formation,
- Factors affecting soil formation, soil forming processes; soil colour, Development, of Soil profile.

**Unit 2**

- Taxonomic classification of soils; soils of Haryana and India;
- Soil physical properties, Soil texture, Particle size distribution system, Soil structure classification and its significance, Soil aggregates, Soil consistency and its types,
- Bulk density and particle density of soils & porosity, their significance in agriculture.

**Unit 3**

- Soil crusting; soil compaction; Soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants-hygroscopic coefficient, wilting point,
- Field capacity, moisture equivalent, maximum water holding capacity, soil temperature and thermal properties;
- Soil air and gaseous exchange; influence of soil temperature and air on plant growth.

**Unit 4**

- Soil colloids, Properties, nature, types and significance;
- Layer silicate clays- genesis, charges; adsorption of ions, ion exchange and its significance;
- Soil reaction; soil organic matter- composition, decomposition, mineralization and humus and its fractionation;
- Soil organisms and their significance.

**Practical:**

Identification of rocks and minerals; study and description of a soil profile; determination of bulk density and particle density; soil strength; soil moisture determination; determination of field capacity, infiltration rate, water holding capacity; mechanical analysis of soil; soil temperature; collection and processing of soil samples; determination of organic carbon, pH and electrical conductivity.

**Suggested Readings:**

Biswas, T.D. and Mukherjee, S.K. 2001. Text Book of Soil Science. Tata McGraw Hill Publishing Co., New Delhi
Brady, N.C. 1990. Nature and Properties of Soils. 10th Edn, Macmillian Publishing Co. Inc., New York
Das.D.K, 1997. Introductory Soil Science. Kalyani Publishers, New Delhi.
Foth, H.D. and Turk, L. M. 1972. Fundamental of Soil Science. 5th Edn. Wiley Eastern Pvt. Ltd., New Delhi
Gupta, P.K. 2007. Soil, Plant, Water and Fertilizer Analysis. Published by AGROBIOS (India), Jodpur
ISSS, 2002. Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI, New Delhi
Jaiswal, P.C. 2006. Soil, Plant and Water Analysis. 2nd Edn. Kalyani Publishers, ludhiyana

**Overview:**

The course has been designed to help the students in building the confidence and speak confidently. It will help them to focus on communication activities in functional and situational contexts as well as enhance the four language skills of reading, writing, listening and speaking through real-life and professional situations.

The course will make the students capable of effective Communicator which will helps the candidate in building a good relationship between the employer and the employee.

**Objective and Expected Outcome**

1. To perform all managerial functions and to achieve predetermined goals
2. To exchange information
3. To formulate and execute the plans
5. To create consciousness and Coordinate and cooperate
6. To create relationship, in solving problems and decision making

<b>SAMA149A</b>	<b>Introduction to Statistical methods</b>	<b>Credits:02(2+0)</b>
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**Overview:**

This subject deals with the fundamentals of statistics, concept, correlation of data, probability, statistical hypothesis, level of significance and tests of significance, experimental design, layout and analysis of data.

**Objective and Expected Outcome**

1. To study the basic aspects of statistics.
2. To study the concept, correlations, probability and distribution.
3. To study the hypothesis and significance.
4. To study the principles of experimental design, layout, model and analysis  
After studying the subjects the will be enriched with the knowledge of role of statistics in agriculture and can compare the date for significance.

**Theory**

**Unit-1**

- Definition, uses and limitations of Statistics,
- Concepts of population and sample, concepts of data types- nominal, ordinal, discrete and continuous data,
- Graphical presentation of data. Frequency distribution, frequency curve, Measures of central tendency (Arithmetic Mean, Median and Mode),
- Measures of dispersion (Range, Mean deviation, Standard deviation and Coefficient of variation). Measures of skewness and kurtosis

**Unit- 2**

- Concepts of bivariate data, correlation and their types,
- Scatter diagram, Karl Pearson correlation coefficient,
- Spearman rank correlation coefficient, Simple linear regression analysis

**Unit-3**

- Basic concepts of probability, Simple Problems Based on Probability,
- Normal distribution and its properties, Concept of parameter, statistics
- Statistical hypothesis, null and alternative hypothesis, level of significance, type-I and type-II errors, degrees of freedom.
- Tests for single mean and comparison of two means, F-test and applications, Chi-square test in 2X2 contingency table, Yates correction for continuity

**Unit-4**

- Principle of experimental design, layout, model
- Analysis of completely randomized design (CRD), randomized block design (RBD) and Latin square design (LSD)

**Suggested Readings:**

Gupta, S.C. and Kapoor, V.K. (1997): Fundamentals of Mathematical Statistics. Sultan Chand and Sons Publisher, New Delhi.
Chakravorthi, S.R. and Giri, N. (2002): Basic Statistics. South Asian Publishers, New Delhi-110014.
Rangaswamy, R. (2002): A text book of Agricultural Statistics. John Wiley and Sons.
Balakrishnan, N. (2002): Statistical Methods and Practice. Prentice Hall of India.
Ferrol, H. Zar. (2005): Biostatistical Analysis: Fourth Edition, Pearson Education, India.

SAMA163A	Basics of Mathematics	Credits:04(4+0)
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**Overview:**

This subject is been planned to impart the basic knowledge of algebra, co-ordinated geometry, trigonometry and calculus to biology based students.

**Objective and Expected Outcome**

1. To study the matrices.
2. To study the various forms of the equation of a line, angle between two lines
3. To study trigonometric ratios of five standard angles; allied angles
4. To study Trigonometric ratios of five standard angles; allied angles

**Theory:**

**Unit-1**

- **Algebra:** Properties of determinants up to 3<sup>rd</sup> order and their evaluation.
- Definition of matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3<sup>rd</sup> order and their properties
- **Unit-2**
- Co- ordinate geometry: Distance between two points,
- Slope of a line, various forms of the equation of a line, angle between two lines

**Unit 3**

- Trigonometry: Trigonometric ratios of five standard angles; allied angles,
- Addition and subtraction formulae, sum and product formulae;
- t-ratios of multiple and sub -multiple angles

**Unit-4**

- **Calculus:** Differentiation of  $x^n$ ,  $e^x$ ,  $\sin x$ ,  $\cos x$  from first principle, Derivative of sum, difference, product and quotient of two function,
- Differentiation of function of function, logarithmic , substitution,
- inverse Trigonometric ratios of five standard angles; allied angles,
- integration by substitution and by parts; definite integrals properties

**Suggested Readings:**

Algebra by D. C. Kapoor and Gurbax Singh
Algebra by T. N. Nagpal and K. K. Gupta.
Comprehensive Calculus by R. S. Dahiya.
New Style Calculus for T. D. C. – I.
New Style coordinator Geometry by R. K. Sondhi
Trigonometry by Jiwan

<b>SAAG111A</b>	<b>Introductory Biology</b>	<b>Credits: 04 (3+1)</b>
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**Overview:**

This subject is designed to impart fundamental knowledge of plants and animal systems including the diversity and characteristics of life, origin of life, classification, Cell and cell division, morphology of plants and Role of animals in agriculture.

**Objective and Expected Outcome**

1. To study the origin of life diversity.
2. To study the Binomial nomenclature and classification and cell division
3. To study the morphology of flowering plants and role of animals in agriculture.

The students will learn about the plant classification, multiplication and role of plants and animals in agriculture.

**Theory**

**Unit –1**

- Introduction to the living world, diversity and characteristics of life,
- origin of life,

**Unit –2**

- Evolution and Eugenics. Binomial nomenclature
- Classification Cell and cell division.

**Unit –3**

- Morphology of flowering plants.
- Seed and seed germination.

**Unit –4**

- 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 Readings:**

A.C. Dutta: Text Book of Botany (Latest Ed.). Oxford University Press- India, 2000.
Vidyarthi: Text Book of Botany Part – I. S. Chand and Company, New Delhi, 2002.
Widge and Bhatia: Introduction of Botany. Truman Publishers, Jalandhar, 2010.
Bhojwani, S.S. and Bhatnagar, S.P., 1992, The Embryology of Angiosperms, Vikas Publishing House, New Delhi.

	(Open Elective)	Credits: 6(6+0)
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## 2<sup>nd</sup> Semester 1<sup>st</sup> year

SAAG104A	Principles of Agronomy	Credit: 03(2+1)
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### Overview:

The main purpose of the subject is to understand the history and importance of agronomy, Classification of crops, yield attributes, agronomic principals, Soil fertility and productivity and Factors affecting soil health. The students will also be apprised with knowledge Cropping system, Manures and fertilizers and Nutrient content of different fertilizers and fertilizer requirement of various crops.

### Objective and Expected Outcome

1. To study history importance and scope of agronomy.
2. To study Classification of crops and water requirements.
3. To study the principal involved in crop production and Soil fertility and productivity,
4. To study soil health, Cropping system, Nutrient content and fertilizer requirements of crops.

The students will know about agronomy, crop classification, soil fertility, productivity, soil health cropping system and the fertilizer requirements of different crops.

### Theory:

#### Unit- 1

- Definition, history and importance of agronomy, meaning and scope of agronomy,
- Classification of crops according to agronomy, seasonal, life span, seed size, root depth, and water requirement etc.
- National and international agricultural research institutes in India and abroad

#### Unit- 2

- Characteristics of good seed, its type and multiplication, crop growth rate, yield
- yield attributes factors affecting them, agronomic principal involved in crop production, tilth and tillage, its importance, objective and its requirements for major crops of Haryana

#### Unit 3

- Soil fertility and productivity, their importance in crop production
- Factors affecting soil health, management of degraded soils

#### Unit- 4

- Cropping system, cropping pattern, farming systems,
- Manures and fertilizers, time and method of application,
- Nutrient content of different fertilizers, and fertilizer requirement estimation of major crops of Haryana

### Practical:

Study of primary and secondary tillage implements, ploughing, puddling and soil preparation, seeding equipments, methods of sowing, study of inter cultivation implements, identification of crops (ralic kharif or both), weeds and their seeds, , seed test for purity, germination and moisture content, calculation of seed rate, seedarium, identification of simple and complax fertilizers their nutrient composition.

### Suggested Readings

Balasubramaniyan, P and Palaniappan, S.P. 2001. Principles and Practices of Agronomy. AgroBios (India) Ltd., Jodhpur.
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Brady, N.C. and Well, R.R. 2002. The Nature and Properties of Soils (13th ed.). Pearson Education, Delhi.
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De, G.C.1989. Fundamentals of Agronomy. Oxford and IBH Publishing Co., New Delhi.
Reddy. T.Y and Reddy, G.H.S.1995. Principles of Agronomy, Kalyani Publishers, Ludhiana.
Khadekar, S.R. 2001. Meteorology. Agromet publishers, Nagpur
Prasada Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Second Edition. Keral Agricultural University, Thrissur.
Varshneya, M.C. and Balakrishna Pillai, B. 2003. Textbook of Agricultural Meteorology. ICAR, New Delhi.

SAAG106A	Biochemistry	Credits: 3(2+1)
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### Overview:

This course has been designed to impart fundamental knowledge of Biochemistry, Carbohydrate, Lipids and Proteins. Concepts and applications of plant biotechnology, Somatic hybridization and cybrids; Cryo-preservation. Introduction to recombinant DNA methods: Transgenic PCR techniques and its applications; RFLP, RAPD, SSR; Biotechnology regulations.

### Objective and Expected Outcome

1. To study Importance of Biochemistry, Carbohydrate, lipids and Proteins.
2. To study Concepts and applications of plant biotechnology.
3. To study introduction to recombinant DNA methods
4. To study Transgenic and Biotechnology regulations.

The students will be benefitted by knowing the fundamentals of biochemistry and biotechnology pertaining to the use of transgenic in agriculture.

### Theory:

#### Unit –1

- Importance of Biochemistry. Properties of water, pH and buffer.
- Carbohydrate: importance and classification.
- Structures of monosaccharide, disaccharides and polysaccharides,

#### Unit –2

- Lipid: importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids.
- Proteins: structural organization and classification of proteins. Enzymes: general properties and classification;
- Michaelis & Menten and Line Weaver Burk equation; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; A, B & Z DNA; RNA.

#### Unit –3

- 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, Embryo rescue and its significance; Somatic hybridization and cybrids; Cryo-preservation.

#### Unit –4

- 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; Biotechnology regulations.

### Practical

Preparation of solution, pH & buffers, qualitative tests of carbohydrates, lipid and amino acids, sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation technique. Demonstration on isolation of DNA and gel electrophoresis techniques.

**Suggested Readings:**

Conn EE and Stumpf PK, 1989, Outline of Biochemistry, Wiley Eastern Ltd. New Delhi.
Jain JL, 2004, Fundamentals of Biochemistry, 5 <sup>th</sup> edn, S.Chand and Company, New Delhi
David L. Nelson and Michael M. Cox, 2009, Lehninger Principles of Biochemistry, 5 <sup>th</sup> edn, WH freeman.
Bhojwani SS and Razdan MK, 1996, Plant Tissue Culture theory and practice, Elsevier publishers.
Chawla HS., 2002, Introduction to Plant Biotechnology, 2 <sup>nd</sup> edn, Science publishers.

<b>SAAG108A</b>	<b>Fundamentals of Genetics</b>	<b>Credits: 03(2+1)</b>
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### Overview

This subject has been designed to enrich the students with the knowledge of fundamentals genetics with Pre and Post Mendelian concepts of heredity, special types of chromosomes and Chromosomal theory of inheritance. Cell cycle and cell division, Mutation, classification, Sex determination and sex linkage, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept.

### Objective and Expected Outcome

1. To study the fundamentals of genetics, Pre and Post Mendelian concepts.
2. To study Cell cycle and cell division, Linkage and its estimation.
3. To study Cytoplasmic inheritance
4. To study the Gene concepts

The students will be trained with the knowledge of concepts and principles of heredity, Cell cycle and cell division and Gene concepts.

### Theory

#### Unit –1

- Pre and Post Mendelian concepts of heredity
- Mendelian principles of heredity
- Architecture of chromosome i.e. chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere;
- Special types of chromosomes and Chromosomal theory of inheritance.

#### Unit –2

- Cell cycle and cell division- mitosis and meiosis.
- Probability and Chi-square Test. Dominance relationships and Epistatic interactions with example.
- Multiple alleles, pleiotropism and pseudo alleles,
- Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics.

#### Unit –3

- Linkage and its estimation, crossing over mechanisms and chromosome mapping.
- 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 and mutagenic agents. Qualitative & Quantitative traits,
- Polygenes and continuous variations and multiple factor hypotheses.

#### Unit –4

- Cytoplasmic inheritance. Genetic disorders.
- Nature, structure & replication of genetic material.
- Protein synthesis, Transcription and translational mechanism of genetic material,
- Gene concept: Gene structure, function and regulation,

### 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. 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 Readings:**

Gupta, P. K. 2007. Cytogenetics Rastogi Publishers, Meerut
Phundan Singh 1995, Elements of genetics Kalyani Publishers, Ludhiana
Strickberger, M.W. 1996. Genetics (3rd edn.). Mac Millan Publishing Co., New Delhi
Singh B. D., Genetics. Kalyani publisher, New Delhi.
Winchester A M 1967 Genetics (3 rd edn )Oxford and IBH Publishing Co New Delhi

<b>SAAG110A</b>	<b>Fundamentals of Agricultural Extension Education</b>	<b>Credits: 3(2+1)</b>
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### **Overview:**

This subject has been designed to impart knowledge regarding the scope and process; objectives, principles of Extension Education and Extension Programmes plannings pertaining to Rural Development: concept, Community Development, monitoring and evaluation of extension programmes; Transfer of technology: concept and models, capacity building of extension personnel, Principles and Functions of Communication, models and barriers to communication and Agriculture journalism.

### **Objective and Expected Outcome**

1. To study Extension Education-scope objectives and principles of Extension Programme planning.
2. To study concept and definition, monitoring and evaluation of extension programmes;
3. To study various extension/ agriculture development programmes launched by ICAR/Govt. of India
4. To study Principles and Functions of Communication, models and barriers to communication. Agriculture journalism.

The students will know about the programme planning of rural communities launched by governments.

### **Theory**

#### **Unit –1**

- Extension Education- meaning, definition, Types;
- Scope and process; objectives and principles of Extension Education;
- Extension Programme planning-Meaning,
- Process, Principles and Steps in Programme Development.

#### **Unit –2**

- Rural Development: concept, meaning, definition;
- Various rural development programs 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.
- Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes;

#### **Unit –3**

- Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.)
- Post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.).
- New trends in agriculture extension:
- Privatization extension, cyber extension/ e-extension, market-led extension , farmer-led extension, expert systems, *etc.*

#### **Unit –4**

- 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 (News and Social Media), media mix strategies; 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**

Group discussion- exercise; handling and use of audio visual equipments 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 Readings:**

Dharma, O.P. and Bhatnagar, O.P 2000. Education and Communication for Development. Oxford, IBH, New Delhi
Desai, A.R. 2003. Rural Sociology in India. Popular Prakashan, Bombay
Khana, B.S. 1991. Rural Development in South Asia-India. Deep and Deep Publication, New Delhi.
Khatari, G.R. 1991. Rural Development Vo. I and II. Marak Publications Pvt. Ltd., Delhi.
Mollett, S.M. 1984. Planning for Agricultural Development. Martin Press, London.

<b>SAAG112A</b>	<b>Agricultural Microbiology</b>	<b>Credits: 03(2+1)</b>
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**Overview:**

This subject has been designed to enrich the students with the knowledge of microbiology, as we all know microbes are present everywhere somehow influences our daily life either by positively and negatively. Basically we taught the students to how microbe can be improve agriculture production (biofertilizer) and protection (biopesticide)

**Objective and Expected Outcome**

1. To study the fundamentals of agriculture microbiology.
2. To study microbial genetics and recombination.
3. To study the role of microbes in crop improvement
4. To study the concept of microbial genetic engineering in agriculture

Microorganisms can orchestrated the agriculture in better a/biotic stress tolerant.

**Theory**

**Unit –1**

- Introduction to microbial world: Prokaryotic and eukaryotic microbes.

**Unit –2**

- Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.
- Bacterial genetics: genetic recombination transformation,
- Conjugation and transduction, plasmids, transposon.

**Unit –3**

- Role of microbes in soil fertility and crop production: Carbon, nitrogen, phosphorus and sulphur cycles.
- Biological nitrogen fixation- symbiotic, associative and asymbiotic.
- Azolla, bluegreen algae and mycorrhiza. Rhizosphere and phyllosphere.

**Unit –4**

- Microbes in human welfare: silage production,
- Biofertilizers, biopesticides, biofuel production
- 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. 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 Readings:**

<b>Sr. No.</b>	<b>Books</b>
1.	Pelczar MJ, Chan ECS and Kreig NR, 1998, Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2.	Stanier RY, Ingraham, Wheelis MG and Paintor PR, 1986, The Microbiology World, Prentice Hall, New Jersey.
3.	Tauro P, Kapoor KK and Yadav KS, 1989, An Introduction to Microbiology, Wiley Publications, New Delhi.
4.	Alexander M, 1985, Introduction to Soil Microbiology, John Wiley and Sons, New York.
5.	Subba Rao, NS, 1999, Biofertilizers in Agricultural and Agroforestry, Oxford and IBH, New Delhi.

<b>SAAG114A</b>	<b>Soil and Water conservation Engineering</b>	<b>Credits: 02(1+1)</b>
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**Overview:**

This subject has been designed to impart knowledge of Soil and Water Conservation, Forms of water erosion, Gully classification, Soil loss estimation, Introduction to contouring, strip cropping, Contour bund, Principles of erosion control, Principles of wind erosion control.

**Objective and Expected Outcome**

1. To study the Soil and Water Conservation causes of soil erosion.
2. To study Soil loss estimation by universal Loss Soil Equation.
3. To study the principles of wind and water erosion control measures.

The students will be benefitted with the knowledge of soil conservation, water and air erosion and their control.

**Theory**

**Unit –1**

- Introduction to Soil and Water Conservation causes of soil erosion.
- Definition and agents of soil erosion, water erosion: Forms of water erosion.

**Unit –2**

- Gully classification and control measures.
- Soil loss estimation by universal Loss Soil Equation,
- Soil loss measurement techniques.

**Unit –3**

- Principles of erosion control: Introduction to contouring, strip cropping.
- Contour bund. Graded bund and bench terracing.
- Grassed water ways and their design. Water harvesting and its techniques.

**Unit –4**

- Wind erosion: mechanics of wind erosion, types of soil movement.
- Principles of wind erosion 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 Readings:**

Kanetkar, Kulkarni, 2005, Surveying and leveling, AVG Prakasan, 23rd edition .
Ojha, T.P. and A.M. Michael, 2001, Principles of Agricultural Engineering, 3rd edition, Vol.II. Jain Brothers New Delhi.
Singhal, O.P., 1997, Agricultural Engineering.

<b>SAAG116A</b>	<b>Insect Ecology and Pest Management</b>	<b>Credits: 03(2+1)</b>
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**Overview:**

This subject has been designed to impart knowledge on insect ecology, abiotic and biotic factor responsible for insect population dynamics, types of pest, resurgence and outbreak of pest, classification of insecticides and concepts and tools of IPM.

**Objective and Expected Outcome**

1. To study density dependent and density independent factors responsible for insect population dynamics.
2. To study the pest status and classification of insecticides.
3. To study the principles, objectives, concepts and tools of IPM.

After studying the subject the students will be able to manage the pests of crops with the minimum use of synthetic and harmful insecticides.

**Theory**

**Unit –1**

- Insect Ecology: Introduction, Environment and its components.
- Effect of abiotic factors– temperature, moisture, humidity, rainfall, light,
- Atmospheric pressure and air currents.

**Unit –2**

- Effect of biotic factors – food competition, natural and environmental resistance.

**Unit –3**

- Classification of insecticides, toxicity and formulations of insecticides.
- Symptoms of poisoning, first aid and antidotes.
- Categories of pests.
- Concepts, scope and limitations of IPM. Importance of Chemical control, hazards and limitations.

**Unit –4**

- Recent methods of pest control, repellents, anti-feedants,
- Hormones, attractants, gamma radiation.
- Insecticide application equipments and techniques of spray fluids. Insecticides Act 1968.

**Practical**

Insecticides and their formulations. Pesticide application equipments and their maintenance. Types spray nozzles and their use. Survey surveillance and Sampling techniques of insect population for estimation of damage and loss. Demonstrations of Integrated Pest Management Techniques.

**Suggested Readings:**

Atwal, A. S and Bains, S. S. 1989. Applied Animal Ecology. Kalyani Publishers. New Delhi. 245p
David, B.V. and Kumaraswami, T. 1996 Elements of Economic Entomology. Popular Book Depot, Madras. 536 p.
Dhaliwal, G. S. and Ramesh Arora. 1998. Principles of Insect Pest Management. Kalyani Publishers, New Delhi. 297 p.
Dhaliwal, G. S. and Singh, B. 1998. Pesticides – The Ecological Impact in Developing Countries . Commonwealth Publishers, New Delhi. 256p.
Metcalf, C. K. and Flint, W. P. 1970. Destructive and Useful Insects: Their Habits and Control. Tata McGraw Hill Publishing Company. New Delhi. 1074p.

<b>SAAG118A</b>	<b>Fundamentals of Rural Sociology and Educational Psychology</b>	<b>Credits: 02(2+0)</b>
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**Overview:**

This subject has designed to impart knowledge about the the rural community, Rural society, Social Groups, Social Stratification, Culture and Social Change. It is also concerned with the Educational psychology, Personality and , Theories of Motivation and Intelligence.

**Objective and Expected Outcome**

1. To study the Rural sociology its significance in agriculture.
2. To study Rural society, Social Groups, Social Stratification.
3. To study the Educational psychology, Theories of Motivation

The students will be able to understand the rural people structure ans, their agriculture and the personality and the motivational components for rural development.

**Theory**

**Unit –1**

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

**Unit –2**

- Social Ecology, Rural society,
- Social Groups, Social Stratification

**Unit-3**

- Culture concept, Social Institution,
- Social Change & Development.

**Unit –4**

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

**Suggested Readings:**

Desai A. R, 2003, Rural Sociology in India. Popular Parkasan, Bombay.
Samanta. R. K. and Arora, S. K., 1997, An Introduction to Sociology. Kitab MahalS.D.Pvt. Ltd., Allahabad.
Doshi, S. L.and P. C. Jain, 2016, Rural Sociology, Rawat Publications, Jaipur.
Mondal , S. and Ray G. L., 2007, A Text Book of Rural Development. Kalyani Publishers, Chennai.

	<b>Open Elective</b>	<b>Credits: 6(6+0)</b>
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## 3rd Semester 2nd Year

<b>SAAG201A</b>	<b>Crop Production Technology – I (Kharif Crops)</b>	<b>Credits: 02 (1+1)</b>
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### Overview:

This subject has been designed to impart knowledge on the latest and best technology for the production of high yielding crops. This subject emphasizes on growing of high yielding varieties for high food grains.

This course will help the students in making capable for better crop production.

### Objective and Expected Outcome

- To know origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* cereal crops.
- To know origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* pulse crops
- To know origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of fiber and fodder crops.

The students will learn from this course about the best and latest technology to grow high yielding crops and varieties.

### Theory:

#### Unit –1

- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* cereal crops:–
- Rice,
- Maize,
- Sorghum,
- Pearl millets.

#### Unit -2

- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* pulse crops:
- Pigeon pea,
- Mung bean
- Urd bean

#### Unit -3

- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* oilseed crops:
- Groundnut, and Soybean
- Fibre crops- cotton & jute;

#### Unit -4

- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* fodder crops:
- Sorghum, cowpea,
- Cluster bean and napier grass.

### Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea 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, study of

crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of kharif season crops, visit to research centers of related crops.

### **Suggested Readings**

Chatterjee, B.N. 1989. Forage Crop Production- Principles and Practices. Oxford and IBH . New Delhi.
Chidda Singh, Prem Singh and Rajbir Singh. 2003. Modern Techniques of Raising Field Crops (2nd ed.). Oxford and IBH, New Delhi.
Hand Book of Agriculture, 2006, ICAR New Delhi
Pal, M., Deka, J., and Rai, R.K. 1996. Fundamentals of Cereal Crop Production. Tata McGraw Hill Pub., New Delhi
Prasad, R. 1999. A Text Book of Rice Agronomy, Jain Brothers, New Delhi,
Reddy,S.R.2000.Principles of crop production. Kayani Publication
Sankaran, S. Mudaliar, T.V.S.1997. Principles of Agronomy The Bangalore Printing and Publising Company

<b>SAAG203A</b>	<b>Fundamentals of Crop Physiology</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

This subject has been designed to impart knowledge of plants physiology, plant cell its minerals and respiration.

This course will help the students in making the students capable of learning about physiology of the crops.

**Objective and Expected Outcome**

- To know crop physiology
- To know plant cell
- To know mineral nutrition of plants
- To know respiration and glycolysis,

The students will learn from this about best climatic conditions and forecasting the favourable and unfavourable conditions for healthy agriculture.

**Unit –1**

- Introduction to crop physiology and its importance in agriculture;
- Plant cell: an overview; diffusion and osmosis;
- Absorption of water, transpiration and stomata physiology.

**Unit –2**

- Mineral nutrition of plants:
- Functions and deficiency symptoms of nutrients,
- Nutrient uptake mechanisms; Photosynthesis:
- Light and dark reactions, C3, C4 and CAM plants

**Unit –3**

- Respiration: Glycolysis,
- TCA cycle and electron transport chain;
- Fat metabolism: Fatty acid synthesis and breakdown

**Unit –4**

- Plant growth regulators:
- Physiological roles and agricultural uses
- 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, estimation of relative water content.

**Suggested Readings**

Lincoln Taiz and Eduardo Zeiger, 2002, Plant Physiology, 3rd ed, Sinauer Associates
Pessarakli M, 2003, Hand Book of Plant and Crop Physiology, Marcel Dekker, Inc., New York.
Hans Mohr and Peter Schopfer, 1995, Plant physiology, Springer Publications.

SAAG205A	Fundamentals of Horticulture	Credits: 02 (1+1)
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**Overview:**

This subject has been designed to impart knowledge about the classification, seed germination and propagation of fruit trees.

This course helps in making the students capable of multiplication of horticultural crops.

**Objective and Expected Outcome**

- To know branches, importance of horticulture
  - To know climate and soil, propagation and Seed germination of fruit trees.
- The students will learn from this subject about the raising and multiplication of horticultural crops.

**Theory:**

**Unit -1**

- Horticulture - Its definition and branches, importance and scope;
- Horticultural and botanical classification;
- Climate and soil for horticultural crops.

**Unit -2**

- Plant propagation-methods and propagating structures;
- Seed dormancy, Seed germination.

**Unit -3**

- Principles of orchard establishment;
- Principles and methods of training and pruning,
- Chilling requirement, bud dormancy, juvenility,
- Flower bud differentiation, fruit development and fruit ripening;
- Unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy.

**Unit -4**

- 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. Visit to commercial nurseries/orchard

**Suggested Readings:**

Chadha, K.L.2001. Hand Book of Horticulture, ICAR, New Delhi.
Singh, J. 2008. Basic Horticulture, Kalyani publishers.
Gupta, S. N. 2010. Instant Horticulture, Jain Brothers Publications
Kumar, N. 2017. Introduction To Horticulture, Oxford & Ibh.
Muthukumar, P. & R Selvakumar, R. 2017. Glaustas Horticulture, Daya Publishing House

<b>SAAG207A</b>	<b>Introductory Forestry</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

This subject has been designed to impart knowledge about the growing and raising technologies of forest and timber trees.

This course will help in making the students capable of raising and maintenance of forests in a particular climate.

**Objective and Expected Outcome**

- To know silviculture, forest classification,
- To know the climate, soil, propagation and Seed germination of forest trees.
- Forest regeneration, Natural regeneration of forest trees.

The students will learn from this subject about the raising and multiplication of horticultural crops

**Theory**

**Unit –1**

- Introduction – definitions of basic terms related to forestry, objectives of silviculture,
- Forest classification, salient features of Indian Forest Policies.

**Unit –2**

- Forest regeneration, Natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers;
- Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.
- Crown classification.

**Unit –3**

- Tending operations – weeding, cleaning, thinning –mechanical, ordinary, crown and advance thinning. Forest mensuration –
- Objectives, diameter measurement, instruments used in diameter measurement; 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 –4**

- 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 Readings:**

Subba Rao, N.S. 1999 .Biofertilizers in Agricultural and Agro forestry .Oxford and IBH , New Delhi.
Grebner, D, Bettinger, P and Siry, J. Introduction to Forestry and Natural Resources Academic Press.
Edmonds, R.L, Agee, J. K. and Gara, R.I. Forest Health and Protection
P. K. R. Nair, 1993, An introduction to agroforestry
Buck, L., Lassoie,J.P., Fernandes and E.C.M., 1998. Agroforestry in Sustainable Agricultural Systems

<b>SAAG209A</b>	<b>Livestock and Poultry Management</b>	<b>Credits: 03 (2+1)</b>
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**Overview:**

This subject has been designed to impart knowledge about the role of livestock in the national economy, reproduction, Management of milch animals, poultry and prevention from diseases.

This course will help in making the students capable of raising of dairy and poultry farms.

**Objective and Expected Outcome**

- To know Role of livestock in the national economy
- To know Reproduction in farm animals and poultry
- To know important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry.
- To know prevention and control of important diseases of livestock and poultry

The students will learn from this subject about the raising of dairy and poultry farms as entrepreneur.

**Theory**

**Unit –1**

- Role of livestock in the national economy. Introduction of livestock Present status and future prospectus of various livestock programme.
- Reproduction in farm animals
- Housing principles, space requirements for different species of livestock

**Unit –2**

- Management of calves, growing heifers and milch animals. Feeding and management of calves, growing heifers and milch animals etc.
- Management of sheep, goat and swine

**Unit –3**

- , Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine
- Improvement of farm animals
- Prevention and control of important diseases of livestock

**Unit –4**

- Housing principles poultry, Digestion in poultry.
- Reproduction Exotic breeds of poultry. Reproduction in poultry, Incubation, hatching and brooding. Management of growers and layers.
- Poultry diseases. Prevention and control
- Classification of feedstuffs. Proximate principles of feed.

**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 equipments. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

**Suggested Readings:**

Banerjee, G.C. 2018. A Text Book of Animal Husbandry. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
Dairy India Year Book 2001. A-25, Priyadarshini Vihar, DELHI.
Hand book of Animal husbandry-Indian Council of Agricultural Research Publication, New Delhi, Third Edition, 2002
Sastry, N.S.R & Thomas C.K, 2018 : Livestock Production and Management, Kalyani Publishers, India

<b>SAAG213A</b>	<b>Renewable Energy and Green Technology</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

The course will help the students in knowing the various types of renewable sources of energy like biogas, solar and wind and their application.

**Objective and Expected Outcome**

1. To know the classification of energy sources,
2. To familiarize with different types of biogas solar energy, wind energy plants

**Theory**

**Unit –1**

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

**Unit –2**

- Familiarization with types of biogas plants and gasifiers, biogas, bio alcohol, biodiesel and bio oil production and their utilization as bioenergy resource,
- Introduction of solar energy, collection and their application.

**Unit –3**

- Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application

**Unit –4**

- 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 Readings:**

Jeremy Shere, 2013, <u>Renewable: The World-Changing Power of Alternative Energy</u> , St. Martin's Press
Robert Ehrlich, 2013, <u>Renewable Energy: A First Course</u> , CRC Press
David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, 2014, <u>Renewable Energy Systems</u> , Pearson Publisher

SAAG215A	Fundamentals of Plant Pathology	Credits: 03 (2+1)
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### Overview:

This subject has been designed to impart knowledge about the basic aspects of plant diseases. The biology, life cycles of various causal organisms of plant diseases are taught. This course will help in making the students capable of knowing about various microbial organisms like fungi, bacteria viruses and others.

### Objective and Expected Outcome

- To know about the plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes
- To know about the factors affecting disease development
- To know types of parasitism and variability in plant pathogens.
- To Epidemiology of crop disease
- To know classification, mode of action and formulations of fungicides

The students will learn from this subject about the crop diseases, their causal organisms and fungicides.

### Theory

#### Unit –1

- *Introduction:* History, Scope and objectives of Plant Pathology with special reference to Indian work.
- Importance, concepts 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. Causes / factors affecting disease development: disease triangle and tetrahedron.

#### Unit –2

- *Fungi:* Definition of fungus, general characters, somatic structures,
- types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual).
- Binomial system of nomenclature, rules of nomenclature,
- Classification of fungi. *Bacteria:* general morphological characters and basic methods of reproduction.

#### Unit –3

- *Viruses:* Nature, structure, replication and transmission.
- Study of phanerogamic plant parasites. *Nematodes:* General morphology and reproduction,
- Symptoms and nature of damage caused by plant nematodes (*Heterodera, Meloidogyne, Anguina, Radopholus* etc.)
- Liberation / dispersal and survival of plant pathogens.

#### Unit –4

- Types of parasitism and variability in plant pathogens.
- Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants.
- Epidemiology: Factors affecting disease development.
- Nature, chemical combination, classification, mode of action and formulations of fungicides

## **Practical**

Acquaintance with various laboratory equipments 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 morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil. Study of fungicides and their formulations.

## **Suggested Readings:**

Agrios, G.N. 2003. Plant Pathology Academy Press. New York.
Dasgupta, M.K. 1998. Principles of Plant Pathology. Allied Publishers Pvt. Ltd. Bangalore
Walia, Raman K. and Bajaj, Harish K., 2003, Textbook on Introductory Plant Nematology, Directorate of Information and Publications of Agriculture, ICAR, New Delhi
Nene, Y.L. and Thapliyal, P.N. 1998. Fungicides in Plant Disease Control. Oxford and IBH New Delhi
Singh, R.S 2002. Introduction to Principles of Plant Pathology. Oxford and IBH Publishing, New Delhi

SAAG217A	Agricultural Finance and Cooperation	Credits: 02 (2+0)
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### Overview:

This subject has been designed to impart knowledge about agricultural finance, agricultural credit, financing agriculture, cooperative credit structure and Private lease system of farming.

### Objective and Expected Outcome

- To know about Agricultural finance: nature and scope
  - To know different parameters of credit
  - To know factors for private loan system
  - To know Agricultural cooperation: philosophy and principles
- The students will learn from this subject about the production, storage and marketing of good seeds.

### Theory

#### Unit-1

- Agricultural finance: nature and scope; time value of money: compounding and discounting; agricultural credit: meaning, definition,
- classification, need, micro finance; credit analysis: different parameters of credit (4Rs, 5Cs and 7Ps ) repayment plans for credit.

#### Unit-2

- History of financing agriculture in India; commercial banks: their nationalization lead bank scheme, regional rural banks, gramin banks,
- Scale of finance; higher financing agencies-RBI, NABARD, AFC, Asian Development Bank (ADB), World Bank, Insurance and Credit Guarantee Corporation of India.
- Factors for private loan system.

#### Unit-3

- Factors and assessment of crop losses: determination of compensation: crop insurance,
- Fasal Bima Yojna and other government scheme advantages and limitations in application, estimation of crop yields.

#### Unit-4

- Agricultural cooperation: philosophy and principles, history of Indian cooperative movement,
- Pre-independence and post independence periods, cooperative credit structure-PACS, DCCB, SCB. Private lease system of farming

### Suggested Readings:

Kahlon,A.S., Singh, Karam. Managing Agricultural Finance. Allied Publishers, New Delhi
Reddy,S., Raghuram,P., Neelakantan,T.V and Bhavani D.I.2004. Agricultural onomics.Oxford and IBH Publishers, New Delhi.
Reddy,S., and Ram,P.R. Agricultural Finance and Management. Oxford and IBH, New Delhi.

<b>SAAG219A</b>	<b>Production Technology for Ornamental Crops, Medicinal and Aromatic Plants and Landscaping</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

The course is designed to impart knowledge regarding the advanced technologies to produce high quality flowers and medicinal and aromatic plants and the art of landscaping.

**Objective and Expected Outcome**

1. To know the Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping
2. To know production technology of important ornamental plants, medicinal plants.
3. To know about the processing and value addition in ornamental crops

**Theory**

**Unit –1**

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

**Unit –2**

- Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.
- Package of practices for loose flowers like marigold and jasmine under open conditions.

**Unit –3**

- Production technology of important medicinal plants like ashwagandha, asparagus, aloe, coleus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver.

**Unit –4**

- 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 Readings:**

Chadha, K.L.2001. Hand Book of Horticulture, ICAR, New Delhi
Kirthikar.K.R. and Basu.B.D. 1993. Indian Medicinal Plants, Vol. 1-4. Lalit Mohan
Kurian, A and Sankar, M.A.2007. Medicinal Plants. New India Publishing Agency, New Delhi

<b>SADM301A</b>	<b>Disaster Management</b>	<b>Credits: 03 (3+0)</b>
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### **Overview**

This course will provide students an exposure to disasters, their significance and types. It ensures that the students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction. It will teach the students a preliminary understanding of approaches of Disaster Risk Reduction (DRR). It will develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

### **Objective and Expected outcome**

1. To create awareness about various types of disasters and to educate the learners about basic disaster management strategies.
2. To examine disaster profile of our country and illustrates the role played by various governmental and non-governmental organizations in its effective management.
3. To acquaint learners with the existing legal framework for disaster management

**UNIT I Introduction to Disasters:** Concept and definitions- Disaster, Hazard, vulnerability, resilience, risks.

**Different Types of Disaster:** Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

### **UNIT- II Disaster Preparedness and Response Preparedness**

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government,
- International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

### **UNIT III Rehabilitation, Reconstruction and Recovery**

- Reconstruction and Rehabilitation as a Means of Development.
- Damage Assessment
- Post Disaster effects and Remedial Measures.
- Creation of Long-term Job Opportunities and Livelihood Options,
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness,
- Dealing with Victims' Psychology, Long-term Counter Disaster Planning, Role of Educational Institute.

### **UNIT IV Disaster Management in India**

- **Disaster Management Act, 2005:**  
Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority
- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**
- **Project Work:** The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

### **Suggested Readings**

Government of India, Department of Environment, Management of Hazardous Substances Control
Act and Structure and Functions of Authority Created Thereunder.
Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
Mrinalini Pandey. Disaster Management- Wiley India Pvt. Ltd.
Tushar Bhattacharya. Disaster Science and Management - McGraw Hill Education (India) Pvt. Ltd.
Jagbir Singh. Disaster Management: Future Challenges and Opportunities - K W Publishers Pvt. Ltd.
J. P. Singhal. Disaster Management- Laxmi Publications.
Leela Krishnan, P. The Environmental Law in India, Chapters VIII, IX and X (1999), Butterworths, New Delhi.

## 4<sup>th</sup> Semester 2<sup>nd</sup> Year

SAAG211A	Crop Production Technology –2 (Rabi Crops)	Credits: 02 (1+1)
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### Overview:

The course will help the students to knowing the students about the Origin, geographical distribution, economic importance, soil and climatic requirements of *Rabi* cereal, pulses, oilseeds and fodder crops.

### Objective and Expected Outcome

1. To know the origin, geographical distribution of rabi crops.
2. To know the varieties, cultural practices of rabi crops.

### Theory

#### Unit –1

- Origin, geographical distribution, economic importance, soil and climatic requirements of *Rabi* cereal crops–wheat and barley and sugarcane
- Varieties, cultural practices and yield of *Rabi* crops: –wheat, barley and sugarcane

#### Unit –2

- *Rabi* pulse crops-chickpea, lentil, peas,

#### Unit –3

- *Rabi* oilseed crops: -rapeseed, mustard and sunflower; sugar crops-sugarcane

#### Unit –4

- *Rabi* Fodder crops: - berseem, lucerne and oats

### 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 Readings:

Chatterjee, B.N. 1989. Forage Crop Production- Principles and Practices. Oxford and IBH . New Delhi.
Chidida Singh, Prem Singh and Rajbir Singh. 2003. Modern Techniques of Raising Field Crops (2nd ed.). Oxford and IBH, New Delhi.
ICAR [Indian Council of Agricultural Research].2006. Hand Book of Agriculture. ICAR, New Delhi
Pal, M., Deka, J., and Rai, R.K. 1996. Fundamentals of Cereal Crop Production. Tata McGraw Hill Pub., New Delhi
Prasad, R. (ed.). 1999. A Text Book of Rice Agronomy, Jain Brothers, New Delhi,

<b>SAAG202A</b>	<b>Farming System and Sustainable Agriculture</b>	<b>Credits: 01 (1+0)</b>
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**Overview:**

This subject has been designed to impart knowledge of present day agriculture, Cropping system and pattern, Integrated farming system and Wasteland development.

This course helps in making the students capable for better crop production.

**Objective and Expected Outcome**

- To know Problems and prospects of present day agriculture
- To know the importance and concepts of agriculture
- To know cropping system and pattern
- To know Integrated farming system
- To know Wasteland and their development

The students will learn from this subject about the best climatic conditions and forecasting the favourable and unfavourable conditions for healthy agriculture.

**Theory:**

**Unit –1**

- Problems and prospects of present day agriculture
- Farming System-scope, importance, and concepts
- Types and systems of farming system
- Factors affecting types of farming
- Farming system components and their maintenance

**Unit -2**

- 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; 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,

**Unit -3**

- 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

**Unit -4**

- Resource cycling and flow of energy in different farming system,
- Farming system and environment,
- Wasteland and their development,
- Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

**Suggested Readings**

Dahama, A.K. 2007. Organic Farming for Sustainable Agriculture. 2nd Edn. Published by AGROBIOS ( India) Jodhpur
Gupta, P.K. 2006. Vermi-composting for Sustainable Agriculture. Published by AGROBIOS ( India) Jodhpur
Sharma, A.K. 2006. A Hand Book of Organic Farming. Published by AGROBIOS ( India) Jodhpur

Sharma, A.K. 2005. Biofertilizers for Sustainable Agriculture. Published by AGROBIOS ( India) Jodhpur
Singh,S.S.2006. Principles and practices of agronomy, Kalyani Publications
Panda,S.C.2003. Cropping and Farming system Agrobios Publications

<b>SAAG204A</b>	<b>Fundamentals of Plant Breeding</b>	<b>Credits: 03 (2+1)</b>
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**Overview:**

This subject has been designed to impart knowledge on the latest and best technology for the development of high yielding varieties of various crops. This subject emphasizes on evolving of high yielding varieties for high food grains.

This course will help in making the students capable for the development of quality and high yielding varieties.

**Objective and Expected Outcome**

- To know genetics in relation to plant breeding.
- To know genetic basis and breeding methods.
- To know concepts of population genetics.
- To know development of inbred lines and hybrids, composite and synthetic varieties.
- To know breeding methods and biotechnological tools

The students will learn from this course about the best and latest technology to produce and evolve good quality, sustainable and high yielding varieties of various crops.

**Unit –1**

- 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.

**Unit –2**

- Domestication, Acclimatization and Introduction; Centers 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; bulk, pedigree and back cross method, Multiline concept.

**Unit –3**

- 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; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties.

**Unit –4**

- 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.
- Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding.

**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. Study of male sterility system. 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 Readings:**

Allard, R.W. 1960. Principles of Plant Breeding. John Wiley and Sons INC. USA. Toppan Co. Ltd. Japan
Choudhari, T.C. 1982. Introduction to Plant Breeding. Oxford and IBH Publishing Co., New Delhi
Elliot. 1958. Plant Breeding and Cytogenetics. Mc Grow Hill. New York

Hayward, M.D., Bosemark, N.O and Romagosa (eds) 1993 Plant breeding- principles and prospects  
Chapman and Hall, London

Singh, B. D. Principles and Methods of Plant Breeding; Kalyani publisher, New Delhi.

<b>SAAG206A</b>	<b>Production Technology of Fruits and Plantation Crops</b>	<b>Credits: 03 (2+1)</b>
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**Overview:**

This subject has been designed to impart knowledge about the technologies for growing and raising of fruit and plantation crops.

This course will help in making the students capable of raising and maintenance of horticultural crops for getting the high production of fruits.

**Objective and Expected Outcome**

- To know branches, importance of horticulture
- Climate and soil, propagation and Seed germination of fruit trees.  
The students will learn from this subject about the raising and multiplication of horticultural crops.

**Theory**

**Unit –1**

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

**Unit –2**

- Production technologies for the cultivation of tropical fruits sapota. Banana litchi, strawberry
- Sub-tropical fruits-mango, , citrus, grape, guava, papaya, date, *ber*, pomegranate

**Unit –3**

- Production technologies for the cultivation of temperate fruits: apple, pear, peach, walnut, almond,
- Other fruits- pineapple, jackfruit.

**Unit –4**

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

**Practical**

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruits. 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 Readings:**

Amar Singh, 1986. Fruit Physiology and Production. Kalyani Publishers, Delhi.
Bose, T.K, Mitra, S.K. and Sanyal, D. 2002. Fruits: Tropical and Subtropical. Vol. I and II, Nayaprakash Publications, Calcutta.
Chadha, K.L.2001. Hand Book of Horticulture, ICAR, New Delhi.
CPCRI, 2003. Coffee Guide, Central Coffee Research Institute, Coffee Board, Chickamangalur, Karnataka.
Kumar.N, Abdul Khader.J.B.M. Rangaswami.P. and Irulappan., 1993. Introduction to Spices – Plantation Crops, Medicinal and Aromatic Plants, Rajalekshmi Pub, Nagercoil.
Bal,J.S.2010 Fruit Growing. Kalyani Publications

<b>SAAG208A</b>	<b>Fundamentals of Agricultural Economics</b>	<b>Credits: 02 (2+0)</b>
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**Overview:**

This subject has been designed to impart knowledge about the micro and macro economics, economic laws as generalization and agricultural planning and development in the country.

This course will help in making the students capable of agricultural planning, demand and supply of agricultural commodities.

**Objective and Expected Outcome**

- To know micro and macro economics
- To know economic laws as generalization
- To know agricultural planning and development in the country.
- To know demand and supply of commodities.

The students will learn from this subject about the agricultural planning of the country.

**Theory**

**Unit –1**

- Economics: Meaning, scope and subject matter, definitions,
- Activities, approaches to economic analysis;
- Micro and macro economics, positive and normative analysis.
- Nature of economic theory; rationality assumption,
- Concept of equilibrium, economic laws as generalization of human behavior.

**Unit –2**

- 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 –3**

- *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 –4**

- *National income*: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.
- Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation.
- Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. *Tax*: meaning, direct and indirect taxes, agricultural taxation, GST. *Economic systems*:
- Concepts of economy and its functions, elements of economic planning.

**Suggested Readings:**

Dewett, K.K. 2005. Modern Economic Theory. S. Chand, New Delhi.
Dewett, K.K., Verma. 2004 Elementary Economic Theory, S.Chand, New Delhi

Jhingam, M. L. 2001. Micro Economic Theory. Konark publishers, New Delhi
Kenneth, E.B.1941. Economic Analysis. Harper and Row, New York.
Reddy,S., Raghuram,P., Neelakantan,T.V.,Bhavani D. I. 2004. Agricultural Economics..Oxford and IBH Publishers, New Delhi.
Lekhi,R.K. and Singh,J.2015.Agricultural Economics:An Indian Perspective. 10 <sup>th</sup> Edition Kalyani Publishers, New Delhi-1100012

<b>SAAG210A</b>	<b>Principles of Seed Technology</b>	<b>Credits: 03 (2+1)</b>
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**Overview:** This subject has been designed to impart knowledge about the Seed and seed technology, Seed certification, seed storage Seed Processing, production and marketing strategies.

This course helps in making the students capable of producing the good quality seed of crops.

### **Objective and Expected Outcome**

- To know Seed and seed technology:
- To know Seed certification
- To know Seed storage
- To know Seed Processing, production and marketing strategies

The students will learn from this subject about the production, storage and marketing of good seeds.

### **Theory**

#### **Unit –1**

- 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 –2**

- Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.
- Seed certification, phases and 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.

#### **Unit –3**

- Detection of genetically modified crops, Transgene contamination in non-GM crops, and organic seed production.
- 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 –4**

- Seed Processing plant and 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, Pigeon pea, 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. Visit to seed production farms, seed testing laboratories and seed processing plant.

### **Suggested Readings:**

Agrawal, P.K. 1994. Principles of Seed Technology, Kalyani Publishers, Ludhiana
Agrawal, R.L. 1990. Seed Technology Kalyani Publishers, Ludhiana

Agrawal, P.K. and N. Dadlani 1995. Techniques in Seed Science and Technology
Neal C. Stoskop, Dwight T. Tomes and B.R. Christie. 2006. Plant Breeding Theory and Practice. Scientific Publishers (India), Jodhpur.
Dahiya, B.S.; Rai, K.N. 1995 Seed Technology, Kalyani Publishers, Ludhiana

<b>SAAG212A</b>	<b>Production Technology for Vegetable and Spice crops</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

The course will help the students to know the students about the Origin, geographical distribution, economic importance, soil, climatic requirements and physiological disorders of *Rabi, kharif* vegetable and spice crops.

**Objective and Expected Outcome**

1. To know the origin, geographical distribution cultural practices of *kharif, rabi* vegetable and spice crops.
2. To know the physiological disorders of *kharif, rabi* vegetable and spice crops.

**Theory**

**Unit –1**

- Importance of vegetables & spices in human nutrition and national economy, types of vegetable gardens.
- 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,
- Physiological disorders of vegetables: Tomato, Brinjal, Chilli, Capsicum, Tuber crops, bulb crops such as Potato, onion and garlic. Leafy vegetables such as Amaranth, spinach; Perennial vegetables.

**Unit –2**

- 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,
- Physiological disorders, of vegetables: Cucumber, Melons, Gourds Pumpkin, French bean, Peas;

**Unit –3**

- 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,
- Physiological disorders, of vegetables: Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, beet root.

**Unit –4**

- 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,
- Physiological disorders and processing of spices: Ginger, turmeric pepper, cardamom, coriander, cumin, fenugreek, clove and cinnamon

**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. Processing of spices, Economics of vegetables and spices cultivation.

**Suggested Readings:**

Sr. No.	Books
1.	Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Delhi.
2.	Choudhury, B.1983. Vegetables. National Book Trust, New Delhi.

	Das, P. C.1993. Vegetable crops in India. Kalyani Publishers
<b>3.</b>	Nybe, E.V, Mini Raj, N and Peter, K.V.2007. Spices. New India Publishing Agency, New Delhi.
<b>4.</b>	Pruthi, J. S. 2001 Minor Spices and Condiments-Crop Management and Postharvest Technology, ICAR, New Delhi, India.
<b>5.</b>	Thamburaj, S. and Singh, N. 2005. Vegetables, Tuber Crops and Spices. ICAR, New Delhi.

SAAG214A	Farm Machinery and Power	Credits: 02 (1+1)
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### Overview:

The course will help the students in knowing the various types of engines and familiarization with Power transmission system. It also tells the students about Tractor types and Implement for agriculture.

### Objective and Expected Outcome

1. To know about different types of engines
2. To know the about different types of tractors and agriculture implements.

### Theory

#### Unit –1

- 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 –2

- 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.

#### Unit –3

- Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement,
- Implement for hill agriculture, implement for intercultural operations.

#### Unit –4

- Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, 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 trans-planter Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

### Suggested Readings:

Sr. No.	Books
1.	Ojha, T.P. and A.M. Michael 2001. Principles of Agricultural Engineering, Vol.I. Jain Brothers New Delhi.3rd edition
2.	Sahay, Jagdiswar. 1977. Elements of Agricultural Engineering. Agro book Agencies
3.	Singhal, O.P. 1977. Agricultural Engineering,

<b>SAAG216A</b>	<b>Agricultural Marketing Trade &amp; Prices</b>	<b>Credits: 03 (2+1)</b>
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### **Overview:**

The course will help the students to knowing the agricultural marketing concepts its classification and characteristics, pricing and promotion strategies, marketing process-concentration, role of Govt. in agricultural marketing and concepts of International Trade

### **Objective and Expected Outcome**

1. To know concepts of agricultural marketing
2. To know pricing and promotion strategies
3. To know marketing process-concentration
4. To know concepts of International Trade

### **Theory**

#### **Unit –1**

- 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.

#### **Unit –2**

- Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities;
- 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:

#### **Unit –3**

- 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);
- 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 hannels 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

#### **Unit –4**

- 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; 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 overtime 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 Readings:**

<b>Sr. No.</b>	<b>Books</b>
1.	Acharya, S.S., Agarwal, N.L.1987. Agricultural Marketing in India. Oxford and IBH, New Delhi.
2.	Acharya, S.S., Agarwal, N.L.1994. Agricultural Prices and Policy. Oxford and IBH, New Delhi.
3.	Philip, K. 2004. Principles of Marketing. Prentice Hall, New Delhi.

<b>SAAG218A</b>	<b>Problematic Soils and their Management</b>	<b>Credits: 02 (1+1)</b>
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### Overview:

The course is designed to impart knowledge regarding Problematic soils under different Agro-ecosystems, soil quality and health, Reclamation and management, Irrigation water – quality and standards and management of problematic soils.

### Objective and Expected Outcome

1. To know different Agro-ecosystems
2. To know soil quality and health
3. To know about the reclamation and management of problematic soils

### Theory

#### Unit-1

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

#### Unit- 2

- Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils,
- Compacted soils, Flooded/ Waterlogged soils.

#### Unit- 3

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

#### Unit- 4

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

### Practical

Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Compacted soils, Flooded/ Waterlogged soils. utilization of saline water in agriculture. Multipurpose tree species, bio remediation

### Suggested Readings:

Sr. No.	Books
1.	Adams, F., 1984. Soil Acidity and Liming. 2nd Edn, American Society of Agronomy, Madison, U.S.A.
2.	Biswas, T.D. and S.K. Mukherjee .1995.Text book of Soil Science. Tata McGraw-Hill Publishing Company Limited, New Delhi.
3.	Das, D.K. 1997. Introductory Soil Science. Kalyani Publishers,
4.	Brady, N.C. and R.R. Well. 2007. The Nature and Properties of soil. 13th edition. Dorling Kindersley (India) Pvt. Ltd., New Delhi – 110092
5.	Das.D.K, 1997. Introductory Soil Science. Kalyani Publishers, New Delhi.

<b>SAAG220A</b>	<b>Agriculture Informatics</b>	<b>Credits: 02 (2+0)</b>
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**Overview:**

- The course is designed to impart knowledge regarding Computers, Operating Systems, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Geospatial technology for generating valuable agri-information. Preparation of contingent crop-planning using IT tools.

**Objective and Expected Outcome**

1. To know the World Wide Web (WWW): Concepts and components
2. To know production technology of important ornamental plants, medicinal plant.
3. To know about the processing and value addition in ornamental crops

**Theory**

**Unit –1**

- Introduction to Computers, Operating Systems,
- Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture

**Unit-2**

- World Wide Web (WWW): Concepts and components. 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-3**

- 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.*

**Unit-4**

- Geospatial technology for generating valuable agri-information. 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.

**Suggested Readings:**

Sharma K.V.S. 2001. Statistics made simple: Do it yourself on PC. Prentice Hall of India.
Capron.H.L. 1996. Computers – Tools for an information age – Fourth Edition. The Benjamin / Cummings Publishing Company, Inc., New York.
Peter Nortons. 2001. Introduction to Computers – Fourth Edition. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
P.K. Sinha 2009. Computer Fundamentals-Third Edition. BPB publication

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	<b>Elective</b>	<b>Credits: 03 (2+1)</b>
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## 5<sup>th</sup> semester 3<sup>rd</sup> year

<b>SAAG301A</b>	<b>Principles of Integrated Disease Management</b>	<b>Credits: 02 (1+1)</b>
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### Overview:

The course will help the students to knowing the economic importance of crop diseases, methods of detection and diagnosis of diseases and principles and methods of plant disease management.

### Objective and Expected Outcome

1. To know the importance of plant diseases.
2. To know the classification of plant diseases.
3. To know the methods of detection and diagnosis of diseases
4. To know the principles and tools of IDM and safety during pesticide uses

### Theory

#### Unit –1

- Categories of diseases, IDM: Introduction, history, importance, concepts,
- Principles and methods of plant disease management, principles and tools of IDM.
- Economic importance of diseases. Methods of detection and diagnosis of diseases.

#### Unit –2

- Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment.

#### Unit –3

- Introduction to conventional pesticides for disease management.
- Survey surveillance and forecasting of diseases. Development and validation of IDM module.

#### Unit –4

- Implementation and impact of IDM (IDM module for disease).
- Safety issues in pesticide uses. Ecological, social and legal implication of IDM.

### Practical

Methods of diagnosis and detection of various plant diseases, Methods of plant disease measurement, Assessment of crop yield losses, calculations based on economics of IDM, Mass multiplication of *Trichoderma*, *Pseudomonas*, etc. Identification and nature of damage of important diseases and their management. Crop (agroecosystem) dynamics of selected diseases. Plan & assess preventive strategies (IDM module) and decision making. Crop monitoring attacked by pathogen.

### Suggested Readings:

Sr. No.	Books
1.	Agrios, G.N. 2003. Plant Pathology Academy Press. New York.
2.	Dasgupta, M.K. 1998. Principles of Plant Pathology. Allied Publishers Pvt. Ltd. Bangalore
3.	Maloy. O.C. 1993. Plant Disease Control. Principles and Practice. John Wiley and Sons.Inc. New York
4.	Nene, Y.L. and Thapliyal, P.N. 1998. Fungicides in Plant Disease Control. Oxford and IBH New Delhi
5.	Singh. R.S 2002. Introduction to Principles of Plant Pathology. Oxford and IBH Publishing, New Delhi

<b>SAAG302A</b>	<b>Manures, Fertilizers and Soil Fertility Management</b>	<b>Credits: 03 (2+1)</b>
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### **Overview:**

The course will help the students to knowing the importance of organic manures and fertilizers, Integrated nutrient management, classification, composition, Soil fertility, productivity and methods of fertilizer use.

### **Objective and Expected Outcome**

- 1.To know the importance of organic manures
- 2.To know the classification, composition and properties of fertilizers
- 3.To know the role, deficiency and toxicity symptoms nutrients.
- 4.To know the factors influencing nutrient use

### **Theory**

#### **Unit –1**

- 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 –2**

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

#### **Unit –3**

- Soil fertility and productivity, 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.

#### **Unit –4**

- Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation,
- Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Fertilizers Indicator plants (crop).
- Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

### **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 Readings:**

Burges, A, and Raw, F. 1967. Soil Biology. Acad. Press, New York
Donahu, L. R., Miller, W. R. and Shickuluna, 1977. Soils. Prentice Hall of India Pvt. Ltd., New Delhi
Mengel, K.J. and Kirkby, A. 1978. Principles of Plant Nutrition. International Potash Institute, Switzerland
Nyle.C. Brady 1995. The Nature and Properties of Soils. 10th Edn. Printice Hall India Pvt.. Ltd. New Delhi
Raymond W Miller and Roy L. Donahue. 1992. Soils and Introduction to Soils and Plant Growth. 6th edn. Printice Hall India pvt. Ltd. New Delhi

<b>SAAG303A</b>	<b>Pests of Crops and Stored Grains and their Management</b>	<b>Credits: 03 (2+1)</b>
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**Overview:**

The course will help the students to knowing the different types of insect pests and non insect pests of various crops and store grains and their management.

**Objective and Expected Outcome**

1. To know the importance of insect and non insect pests of various crops and sored grains.
2. To know the management practices of pests of crops and stored grains.

**Theory**

**Unit –1**

Classification, host range, distribution, biology and bionomics, nature of damage, and management of major insect pests and non insect pests of vegetable, fruit, and plantation crops

**Unit –2**

Classification, host range, distribution, biology and bionomics, nature of damage, and management of major insect pests and non insect pests of ornamental, spices and condiment crops.

**Unit –3**

Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage.

**Unit –4**

Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain.

**Practical**

Identification of various insect pests and their nature of damage on Field, Vegetable, Fruit, Plantation, spice crops & condiments. study of life cycle and seasonal history. Pesticide application techniques. Identification of insect pests and Mites, rodents, birds associated with stored grains and their management, assessment of losses due to insect pests. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur Visit to nearby silos/ FCI godowns.

**Suggested Readings:**

Atwal, A. S. 1991. Agricultural Pests of India and South – East Asia. Kalyani Publishers, New Delhi. 529p.
David, B. V. 2001. Elements of Economic Entomology. Popular Book Depot, Madras, 536p.
Ghosh, S. K. Dubey, S. L. 2003. Integrated Management of Stored Grain Pests. International Book Distributing Company. 263p.
Nair, M. R. G. K. 1986. Insects and Mites of Crops in India. Indian Council of Agricultural Research, New Delhi. 267p.
Pradhan, S. 1983. Agricultural Entomology and Pest Control. Indian Council of Agricultural Research, New Delhi. 267p.

SAAG304A	Diseases of Field and Horticultural Crops and their Management- I	Credits: 03 (2+1)
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### Overview:

The course will help the students to knowing the different types of diseases of various kharif grain and vegetable crops and fruit trees and their management.

### Objective and Expected Outcome

1. To know the importance of diseases of various kharif grain and vegetable crops
2. To know the management practices of diseases of field crops and vegetable crops and fruit trees.

### Theory

#### Unit –1

- Symptoms, etiology, disease cycle and management of major diseases of 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 (pearlmillet): downy mildew, powdery mildew and ergot; Groundnut: Tikka and wilt.

#### Unit –2

- Symptoms, etiology, disease cycle and management of major diseases of Soybean: *Rhizoctonia* blight, bacterial spot, and mosaic; 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.

#### Unit –3

- Symptoms, etiology, disease cycle and management of major diseases of 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 –4

- Symptoms, etiology, disease cycle and management of major diseases of Tomato: damping off, wilt, early and late blight, leaf curl and mosaic; Okra: Yellow Vein Mosaic;
- Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: *Phytophthora* blight; 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 Readings:

Sr. No.	Books
1.	Singh, R.S 2001. Plant Disease Management, Oxford and IBH Publishing Co N. Delhi.
2.	Mehrotra. R. S. Plant Pathology, TATA Mechgrow Hill Pub. Co. N. Delhi.
3.	Ramakrishnan, T. S. 1971. Diseases of Millets. ICAR.
4.	Sharma, P. D. 2001. Plant Pathology, Rastogi Publications, Shivaji Road, Meerut.
5.	Singh, R. S. 1995. Diseases of Vegetables Crops. Oxford and IBH Publishing Co.

SAAG305A	Crop Improvement-I ( <i>Kharif</i> Crops)	Credits: 02 (1+1)
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**Overview:**

The course will help the students to knowing the origin, distribution of species, wild relatives in different field crops, vegetable crops and fruit trees and adaptability, stability, abiotic and biotic stress tolerance and quality of different crops.

**Objective and Expected Outcome**

1. To know the origin, distribution various *kharif* grain and vegetable crops
2. To know the major breeding objectives and procedures of field crops and vegetable crops and fruit trees.

**Theory**

**Unit –1**

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

**Unit –2**

- Plant genetic resources, its utilization and conservation,
- Study of genetics of qualitative and quantitative characters.

**Unit –3**

- 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 –4**

- 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, Pigeon pea, Urd bean, Mung bean, Soybean, Groundnut, Sesame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different *Kharif* crops. 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 Readings:**

Strickberger, M.W. 1996. Genetics (3rd edn.). Mac Millan Publishing Co., New Delhi
B. D. Singh 2015 Plant Breeding. Principles & Methods. Kalyani Publishers. 10 th Edition.

<b>SAAG306A</b>	<b>Entrepreneurship Development and Business Communication</b>	<b>Credits: 02 (2+0)</b>
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**Overview:**

The course will help the students to knowing the concepts of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs, impact of economic reforms on Agribusiness and developing the managerial skills and business leadership skills.

**Objective and Expected Outcome**

1. To know the concept of entrepreneur and business.
2. To know the Government policy and programs and institutions for entrepreneurship

**Theory**

**Unit –1**

- Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation,
- Government policy and programs and institutions for entrepreneurship development

**Unit –2**

- Impact of economic reforms on Agribusiness/ Agri-enterprises,
- Entrepreneurial Development Process; Business Leadership Skills.

**Unit –3**

- 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 –4**

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

**Suggested Readings:**

Downey,W.D., Troche, J.K. 1981. Agribusiness Management. Mc Graw Hill Inc.,New Delhi
Gittinger, J.P.1982. Economic Analysis of Agricultural Projects. The Johns Hopkins University Press, Baltimore
Alagumani, T., Chinnaiyan, P.,Elangovan, S.1998. Agricultural Management. Publishers K9 International, Madurai.
Philip,K. 2004. Marketing Management. Prentice Hall, New Delhi.

<b>SAAG307A</b>	<b>Geoinformatics and Nano-technology and Precision Farming</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

1. The course will help the students to knowing Geo-informatics concepts, tool and techniques; their use in Precision Agriculture and remote sensing concepts and application in agriculture and Land use planning: concept, techniques.

**Objective and Expected Outcome**

1. To know the concept of Geo-informatics and Precision Agriculture
2. To know the remote sensing concepts and application in agriculture

**Theory**

**Unit –1**

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

**Unit –2**

- 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; Basic concepts of remote sensing and GIS; Global positioning system (GPS), components and its functions;

**Unit –3**

- Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture;
- 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.

**Unit –4**

- Land use planning: concept, techniques and factors governing present land use; land evaluation methods and soil suitability evaluation for different crops;
- Land capability classification and constraints in application.

**Practical**

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Use of aerial photographs, RS imagery, toposheets and other maps; ground truth study using GPS and visual markings; supervised and unsupervised classification of digital image; Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey.

**Suggested Readings:**

John V. S. (2005). Precision Agriculture.
Pedersen, S. M and Martin, K. (2017). Precision Agriculture: Technology and Economic Perspectives.
<a href="#">Srinivasan, A. (2006). Handbook of Precision Agriculture: Principles and Applications</a>
Rattan Lal, B.A. Stewar (2015). Soil-Specific Farming: Precision Agriculture
National Academy Press, Washington, D.C. (1997). Precision Agriculture in the 21st Century: Geospatial and Information Technologies. National Academies

<b>SAAG308A</b>	<b>Intellectual Property Rights</b>	<b>Credits: 01 (1+0)</b>
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**Overview:**

The course will help the students to knowing the Introduction and meaning of intellectual property, types of Intellectual Property and legislations, patent, filing and International treaty on plant genetic resources for food and agriculture

**Objective and Expected Outcome**

1. To know the intellectual property right, patenting, trade mark and copy rights.
2. To know the International treaty on plant genetic resources and Indian Biological Diversity Act, 2002

**Theory**

**Unit –1**

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

**Unit –2**

- 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 –3**

- 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 breeders rights,
- Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights.

**Unit –4**

- 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 Readings:**

Strickberger, M.W. 1996. Genetics (3rd edn.). Mac Millan Publishing Co., New Delhi
B. D. Singh 2015 Plant Breeding. Principles & Methods. Kalyani Publishers. 10 th Edition.

<b>SAAG309A</b>	<b>Practical Crop Production – I (<i>Kharif</i> crops)</b>	<b>Credits: 02 (0+2)</b>
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**Overview:**

This practical course will help the students to knowing Crop planning, field preparation, Management of insect pest and diseases, Harvesting, threshing, marketing and preparation of balance sheet

**Objective and Expected Outcome**

1. To know the actual crop planning, raising of field crops
2. To know marketing and preparation of balance sheet including cost of cultivation, net

**Practical**

1. Crop planning, raising field crops in multiple cropping systems;
2. field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management
3. Management of insect pest and diseases of crops;
4. Harvesting, threshing, drying, winnowing, storage and marketing of produce;
5. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

	<b>Elective</b>	<b>Credits: 03 (2+1)</b>
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## 6<sup>th</sup> semester 3<sup>rd</sup> year

SAAG311A	Rain-fed Agriculture and Watershed Management	Credits: 02 (1+1)
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### Overview:

This course will help the students to knowing Rainfed agriculture its Problems and prospects, soil and climatic conditions prevalent in rainfed, management of crops in rainfed areas. Factors affecting watershed management and principles of intercropping.

### Objective and Expected Outcome

- 1.To know the actual rainfed agriculture
- 2.To know the concepts, objective, principles and components of watershed management

### Theory

#### Unit –1

- Rainfed agriculture: Introduction, types, climatic and edaphic characteristics, History of rainfed agriculture and watershed in India;
- Problems and prospects of rainfed agriculture in India.

#### Unit –2

- Soil and climatic conditions prevalent in rainfed areas; 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 –3

- Management strategies of rainfed crops; critical stages of life saving irrigations.
- Water harvesting: importance, its techniques, efficient utilization of water through soil and crop management practices,
- Management of crops in rainfed areas.

#### Unit –4

- Contingent crop planning for aberrant weather conditions,
- Concept, objective, principles and components of watershed management, factors affecting watershed management. Study of mulches and anti-transpirants;
- water harvesting and moisture conservation; principles of intercropping, cropping systems/intercropping in rainfed agriculture.

### 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 Readings:

Gurnel Singh, C. Venkataraman, G., Sastry,B. and Joshi, P. 1990. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co., New Delhi.
Hansen, V.E., Israelsen, O.W., and Stringham, G.E. 1979. Irrigation Principles and Practices (4th ed.).

John Wiley and Sons, New York
IARI [Indian Agricultural Research Institute]. 1977. Water Requirement and Irrigation Management of Crops in India, IARI Monograph No.4, Water Technology Centre, IARI, New-Delhi.
Lenka, D. 2001. Irrigation and Drainage. Kalyani Publishers, New-Delhi.
Mal, B. C.2002. Introduction to Soil and Water Conservation Engineering, Kalyani Publishers, New-Delhi.

<b>SAAG312A</b>	<b>Protected Cultivation and Secondary Agriculture</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

This practical course will help the students in knowing the types of Green Houses, design criteria, Cost estimation and economic analysis, Important Engineering properties and material and equipment handling.

**Objective and Expected Outcome**

- 1.To know the green house technology
- 2.To know the important engineering properties and handling of equipments

**Theory**

**Unit –1**

- Green house technology: Introduction, Types of Green Houses, Plant response to Green house environment, Planning and design of greenhouses,
- Design criteria of green house for cooling and heating purposes.

**Unit –2**

- Green house equipments, materials of construction for traditional and low cost green houses.
- Irrigation systems used in greenhouses, typical applications, passive solar greenhouse, hot air green house heating systems, green house drying,
- Cost estimation and economic analysis.

**Unit –3**

- 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 –4**

- 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, re-circulatory dryer and solar dryer).
- Material handling equipment; conveyer and elevators, their principle, working and selection.

**Practical**

Study of different type of green houses based on shape. Determination of the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. 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 Readings:**

Balraj Singh. 2005. Protected Cultivation Of Vegetable Crops, Kalyani Publishers
Brahma Singh. 2015. Advances in Protected Cultivation, New India Publishing Agency.
Dahiya, B.S.; Rai, K.N. 1995 Seed Technology, Kalyani Publishers, Ludhiana

SAAG313A	Diseases of Field and Horticultural Crops and their Management-II	Credits: 03 (2+1)
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### Overview:

This course will help the students in knowing the diseases of rabi gain crops, vegetable crops and fruit trees, symptoms and management of diseases.

### Objective and Expected Outcome

1. To know the symptoms, etiology, disease cycle and management of diseases of rabi field and vegetable crops and fruit trees.
2. To know the management of plant diseases.

### Theory

#### Unit –1

- Symptoms, etiology, disease cycle and management of diseases of Field Crops: Wheat: rusts, loose smut, Karnal bunt, powdery mildew, *Alternaria* blight,
- Ear cockle/*molya disease*; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

#### Unit –2

- Symptoms, etiology, disease cycle and management of diseases of Sunflower: Sclerotinia stem rot and *Alternaria* blight; Mustard: *Alternaria* blight, white rust, downy mildew
- Sclerotinia stem rot; chickpea: wilt, grey mould and *Ascochyta* blight; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

#### Unit –3

- Symptoms, etiology, disease cycle and management of diseases of 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, leaf roll, and mosaic;

#### Unit –4

- Symptoms, etiology, disease cycle and management of diseases of 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, Rose: dieback, powdery mildew and black leafspot.

### 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 Readings:

Singh, R.S 2001. Plant Disease Management, Oxford and IBH Publishing Co. N. Delhi.
Mehrotra. R. S. Plant Pathology. TATA Mechgrow Hill Pub. Co. N. Delhi.
Ramakrishnan, T. S. 1971. Diseases of Millets. ICAR.
Sharma, P. D. 2001. Plant Pathology, Rastogi Publications, Shivaji Road, Meerut.
Singh, R. S. 1995. Diseases of Vegetables Crops. Oxford and IBH Publishing Co.

<b>SAAG314A</b>	<b>Post-harvest Management and Value Addition of Fruits and Vegetables</b>	<b>Credits: 02 (1+1)</b>
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**Overview:**

This course will help the students in knowing the diseases of rabi gain crops, vegetable crops and fruit trees, symptoms and management of diseases.

**Objective and Expected Outcome**

1. To know the symptoms, etiology, disease cycle and management of diseases of rabi field and vegetable crops and fruit trees.
2. To know the management of plant diseases.

**Theory**

**Unit –1**

- Importance of post-harvest processing of fruits and vegetables,
- Extent and possible causes of post harvest losses

**Unit –2**

- Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening;
- Respiration and factors affecting respiration rate;

**Unit –3**

- Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric);
- Value addition concept

**Unit –4**

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

Wills, R. B. H. 1998. Postharvest, UNSW Press.
Shewfelt, R. L. and Stanley, P. E. 1992. Post Harvest Handling: A Systems Approach, Academic Press Inc.
Prusky, D. and Gullino, M. L. 2010. Postharvest Pathology, Springer.

SAAG315A	Management of Beneficial Insects	Credits: 02 (1+1)
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### Overview:

This course will help the students in knowing Importance of beneficial Insects, pollinators and their role in cross pollinated crops, Beekeeping Commercial methods of rearing, Rearing of silkworm, identification of major parasitoids and Important species of pollinator, weed killers etc.

### Objective and Expected Outcome

1. To know Importance of beneficial Insects
2. To know the commercial rearing of be useful insects.

### Theory

#### Unit –1

- Importance of beneficial Insects, pollinators and their role in cross pollinated crops, Beekeeping, bee biology, Bee pasturage, bee foraging and communication
- Commercial methods of rearing, equipment used, seasonal management, bee enemies, Insect pests and diseases of honey bee.

#### Unit –2

- Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.
- Rearing, mounting and harvesting of cocoons.
- Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

#### Unit –3

- Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.
- Identification of major parasitoids and predators commonly being used in biological control.

#### Unit –4

- 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 silkworm, 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 Readings:

David, B.V. and Kumaraswami, T. 1996 Elements of Economic Entomology. Popular Book Depot, Madras. 536 p.
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SAAG316A	Principles of Organic Farming	Credits: 02 (1+1)
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**Overview:**

This course will help the students in knowing Importance Organic farming, principles, relevance in present context and its scope, organic ecosystem and their concepts, fundamentals of insect, pest, disease and weed management under organic mode of production and marketing and export potential of organic products.

**Objective and Expected Outcome**

1. To know Importance of organic farming,
2. To know the certification process and standards of organic farming

**Theory**

**Unit –1**

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

**Unit –2**

Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; vermi-composting, green manuring, recycling of organic residues, bio-fertilizers.

**Unit –3**

Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production

**Unit –4**

Operational structure of NPOP; Certification process and standards of organic farming; 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, vermicompost, 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 Readings:**

<i>Wishwall, R. The Organic Farmer's Business Handbook</i>
NPCS Board of Consultants & Engineers. The Complete Book on Organic Farming and Production of Organic Compost. Publisher: Asia Pacific Business Press Inc.
Sapna E. Thottathi. India's Organic Farming Revolution: What It Means for Our Global Food System
Tripathy, P. and Thapa, U. Organic Farming In India
Balasubramanian, R., Balakrishnan, K. and Sivasubr, K. Principles & Practices of Organic Farming

SAAG317A	Crop Improvement-II ( <i>Rabi</i> crops)	Credits: 02 (1+1)
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**Overview:**

This course will help the students in knowing Importance

**Objective and Expected Outcome**

1. To know the centers of origin of *rabi* crops.
2. To study of genetics of qualitative and quantitative characters.
3. To know about the hybrid seed production technology of *rabi* crops.

**Theory**

**Unit –1**

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

**Unit –2**

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

**Unit –3**

- 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 –4**

- Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.

**Practical**

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 and Onion. 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 Readings:**

Strickberger, M.W. 1996. Genetics (3rd edn.). Mac Millan Publishing Co., New Delhi
B. D. Singh, 2015, Plant Breeding. Principles & Methods, 10 <sup>th</sup> edition, Kalyani Publishers, New Delhi.

<b>SAAG318A</b>	<b>Farm Management, Production and Resource Economics</b>	<b>Credits: 02 (1+1)</b>
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### **Overview:**

This course will help the students in knowing the meaning and concept of farm management, objectives, Principles of farm management, concepts of cost, farm business analysis, Importance of farm records, concepts of risk and uncertainty occurs in agriculture production and crop/livestock/machinery insurance

### **Objective and Expected Outcome**

1. To know the concepts of farm management
2. To study farm business analysis

### **Theory**

#### **Unit –1**

- 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 –2**

- 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 –3**

- 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.

#### **Unit –4**

- 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. Concepts of resource economics.

### **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 Readings:**

S. Subha Reddy, P. Raghu Ram, V. Neela Kanta Sasgtri, I. Bhavani Devi. Agricultural Economics.
Agrawal, A. N. Indian Agricultural Problems, Progress and Prospects. Vikas Publishing House Pvt. Ltd.
S S. Johl and C.V. Moore. Essentials of Farm Management.
E.O. Heedy and J.L. Dillon. Agricultural Production Functions. Kalyani Publishers.

<b>SAAG319A</b>	<b>Practical Crop Production –II (<i>Rabi</i> crops)</b>	<b>Credits: 02 (0+2)</b>
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**Overview:**

This practical course will help the students in knowing the crop planning, raising rabi field crops, field preparation, management of insect pests and diseases of crops, harvesting, threshing, marketing and preparation of balance sheet.

**Objective and Expected Outcome**

1. To know about the growing of rabi crops.
2. To know about marketing of produce and preparation of balance sheet.

**Practical**

- Crop planning, raising field crops in multiple cropping systems;
- field preparation, seed treatment, sowing, nursery raising, nutrient management, water management, weed management
- Management of insect pests and diseases of crops; harvesting, threshing, drying, winnowing, storage and marketing of produce;
- preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

	<b>Elective</b>	<b>Credits: 03 (2+1)</b>
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## ANNEXURE- I

### ELECTIVE COURSES

**Elective Courses:** A student can select three elective courses out of the following and offered during 4th, 5th and 6th semesters.

#### SYLLABUS OF ELECTIVE COURSES

SAAG221A	Agri-business Management	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge transformation of agriculture into agribusiness. Constraints in establishing agro-based industries. Agri-value chain, Components of a business plan and Marketing mix and marketing strategies.

#### Objective and Expected Outcome

1. To study transformation of agriculture
2. To study agro-based industries.
3. To study Agri-value chain
4. To study marketing strategies

#### Theory

##### Unit-1

- Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy.
- Distinctive features of Agribusiness Management: Importance and needs of agro-based industries,
- Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.

##### Unit-2

- Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis.
- Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget.

##### Unit-3

- Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control.
- Capital Management and Financial management of Agribusiness.
- Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning.

##### Unit-4

- Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods.
- Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation.
- Project Appraisal and evaluation techniques.

**Practical**

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

**Suggested Readings:**

<b>Sr. No.</b>	<b>Books</b>
1.	Subba rao reddy, S. and P. Raghav Rao. Agriculture finance and management. Oxford and IBH Publication company Ltd. New Delhi
2.	Dwivedi, D.N. Managerial Economics. Vikas Publishing House. New Delhi
3.	Dhingra, I.C, Indian economic problems. Sultan chand and sons, New Delhi

SAAG222A	Agrochemicals	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge introduction to agrochemicals, management of agrochemicals Herbicides, fungicides, insecticides ,Biopesticides & Biofertilizers and fertilizers and their importance

### Objective and Expected Outcome

1. To study agrochemicals Herbicides, fungicides, insecticides
2. Biopesticides & Biofertilizers
3. Fertilizers and their importance

### Theory

#### Unit-1

- An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture,
- Management of agrochemicals for sustainable agriculture.

#### Unit-2

- Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper,
- Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action-Dithiocarbamates-characteristics, preparation and use of Zineb and maneb.

#### Unit-3

- Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.
- Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals,
- Insecticide Act and rules, Insecticides banned, withdrawn and restricted use,
- Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

#### Unit-4

- Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate.
- Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures.
- Complex fertilizers: Manufacturing of ammonium phosphates, nitro-phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

### Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of 120 Report of the ICAR Fifth Deans' Committee water soluble P<sub>2</sub>O<sub>5</sub> and citrate soluble P<sub>2</sub>O<sub>5</sub> in single super phosphate. Estimation of potassium in Murreite of Potash/ Sulphate of Potash by flame photometer. Determination of

copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide.  
Determination of thiram. Determination of ziram content

SAAG223A	Commercial Plant Breeding	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge modes of plant reproduction, Genetic purity, hybrid seed production, Quality seed production, IPR issues and variety testing, release.

### Objective and Expected Outcome

1. To study plant reproduction
2. Genetic purity and Quality seed production
3. IPR issues and release of variety

### Theory

#### Unit- 1

- Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production.
- Genetic purity test of commercial hybrids.

#### Unit-2

- Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.
- Quality seed production of vegetable crops under open and protected environment.

#### Unit-3

- Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.
- IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act.

#### Unit-4

- Variety testing, release and notification systems in India.
- Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

### Practical

Floral biology in self and cross pollinated species, selfing and crossing techniques. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system. Learning techniques in hybrid seed production using male-sterility in field crops. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

SAAG224A	Landscaping	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge of landscaping, propagation, Pot plants, Bio-aesthetic planning, lawn and Bonsai establishment and maintenance.

### Objective and Expected Outcome

1. To study landscaping establishment and maintenance.
2. Bio-aesthetic planning,
3. Bonsai establishment

### Theory

#### Unit-1

- Importance and scope of landscaping.
- Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

#### Unit-2

- Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.
- Climber and creepers: importance, selection, propagation, planting

#### Unit-3

- Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents.
- Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning.

#### Unit-4

- Landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.
- Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

### Practical

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Use of computer software, visit to important gardens/parks/ institutes.

SAAG225A	Food Safety and Standards	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge regarding the Factors affecting Food Safety, Hazards and Risks, Food storage, Waste Disposal, Food laws and Standards, Organic foods

### Objective and Expected Outcome

1. To study Food Safety, Hazards and Risks
2. Hazards and Risks
3. Food laws and Standards
4. Organic foods

### Theory

#### Unit-1

- Food Safety – Definition, Importance, Scope and Factors affecting Food Safety.
- Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards.
- Management of hazards - Need. Control of parameters. Temperature control.

#### Unit-2

- Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control.
- Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures.
- Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series.

#### Unit-3

- TQM- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing,
- Water Analysis, Surface Sanitation and Personal Hygiene.
- Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food.

#### Unit-4

- Recent concerns- New and Emerging Pathogens.
- Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics
- Organic foods. Newer approaches to food safety.
- Recent Outbreaks. Indian and International Standards for food products.

### Practical

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

SAAG226A	<b>Biopesticides &amp; Biofertilizers</b>	<b>Credits: 03 (2+1)</b>
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- **Overview:** This subject has been designed to impart knowledge of biopesticides. Classification, Mass production, Biofertilizers. Factors influencing the efficacy of biofertilizers.

### Objective and Expected Outcome

1. To study about the biopesticides and Biofertilizers
2. Mass production of biopesticides and Biofertilizers

### Theory

#### Unit-1

- History and concept of biopesticides.
- Importance, scope and potential of biopesticide.
- Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses.

#### Unit-2

- Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.
- Methods of application of biopesticides.
- Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

#### Unit-3

- Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium*
- *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza.

#### Unit-4

- Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.
- Production Report of the ICAR Fifth Deans' Committee technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.
- FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc.
- Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

### Practical

Isolation and purification of important biopesticides: *Trichoderma* *Pseudomonas*, *Bacillus*, *Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

<b>SAAG227A</b>	<b>Protected Cultivation</b>	<b>Credits: 03 (2+1)</b>
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- **Overview:** This subject has been designed to impart knowledge of Protected cultivation, Greenhouse design, Soil preparation, Irrigation and fertigation, Cultivation of Off-season production crops, pest and disease management.

### **Objective and Expected Outcome**

1. To study about Protected cultivation
2. Greenhouse design
3. Off-season production crops

### **Theory**

#### **Unit-1**

- Protected cultivation- importance and scope, Status of protected cultivation in India
- World types of protected structure based on site and climate.

#### **Unit-2**

- Cladding material involved in greenhouse/ poly house.
- Greenhouse design, environment control, artificial lights

#### **Unit-3**

- Automation. Soil preparation and management, Substrate management.
- Types of benches and containers.
- Irrigation and fertigation management.

#### **UNIT-4**

- Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliun, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.
- Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

### **Practical**

Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

<b>SAAG228A</b>	<b>Micro propagation Technologies</b>	<b>Credits: 03 (2+1)</b>
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**Overview:** This subject has been designed to impart knowledge of cultures, callus and direct organ formation, secondary metabolites and Cryopreservation.

**Objective and Expected Outcome**

1. To study about the cultures, callus
2. Secondary metabolites
3. Cryopreservation

**Theory**

**Unit-1**

- Introduction, History,
- Advantages and limitations

**Unit-2**

- Types of cultures (seed, embryo, organ, callus, cell),
- Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture,

**Unit-3**

- bud culture), Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures,

**UNIT-4**

- Production of secondary metabolites, Somaclonal variation, Cryopreservation

**Practical**

Identification and use of equipments in tissue culture Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for Report of the ICAR Fifth Deans' Committee explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.

SAAG229A	Hi-Tech. Horticulture	Credits: 03 (2+1)
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- **Overview:** This subject has been designed to impart knowledge of high tech horticulture, micro propagation, planting methods, Micro irrigation, precision farming, planting methods, Micro irrigation and mechanized harvesting of produce

#### **Objective and Expected Outcome**

1. To study high tech horticulture
2. Planting methods, Micro irrigation
3. Remote sensing & planting methods, Micro irrigation

#### **Theory**

##### **Unit-1**

- Introduction & importance of high tech horticulture
- Nursery management and mechanization; micro propagation of horticultural crops;

##### **Unit-2**

- Modern field preparation and planting methods,
- Protected cultivation: advantages, controlled conditions, method and techniques,

##### **Unit-3**

- Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding,
- Components of precision farming

##### **Unit-4**

- Remote sensing, Geographical Information System (GIS),
- Differential Geo-positioning System (DGPS),
- Variable Rate applicator (VRA),
- application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

#### **Practical**

Types of polyhouses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-protrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

<b>SAAG230A</b>	<b>Weed Management</b>	<b>Credits: 03 (2+1)</b>
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- **Overview:** This subject has been designed to impart knowledge of reproduction and dissemination of weeds, Herbicide, Herbicide compatibility, herbicide formulation

### **Objective and Expected Outcome**

1. To study reproduction and dissemination of weeds
2. Herbicide formulation and compatibility

### **Theory**

#### **Unit-1**

- Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem.
- Classification, reproduction and dissemination of weeds.

#### **Unit-2**

- Herbicide classification, concept of adjuvant, surfactant,
- herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity

#### **Unit-3.**

- Allelopathy and its application for weed management.
- Bio-herbicides and their application in agriculture.

#### **Unit-3**

- Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agrochemicals and their application.
- Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

### **Practical**

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixtures. Herbicide and agrochemicals study. Shift of weed flora study in long term experiments. Methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

SAAG231A	System Simulation and Agro advisory	Credits: 03 (2+1)
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**Overview:** This subject has been designed to impart knowledge of Crop models, concepts & techniques, weather elements; growth models, nutrients balance, Weather forecasting, simulation model, Agro-advisory

**Objective and Expected Outcome**

1. To study about the Crop models
2. Growth models, nutrients balance
3. Weather forecasting

**Theory**

**Unit-1**

- System Approach for representing soil-plant-atmospheric continuum, system boundaries,
- Crop models, concepts & techniques

**Unit-2**

- types of crop models, data requirements, relational diagrams.
- Report of the ICAR Fifth Deans' Committee Evaluation of crop responses to weather elements;

**Unit-3**

- Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation.
- Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

**Unit-4**

- Weather forecasting, types, methods, tools & techniques, forecast verification;
- Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars;
- Preparation of agro-advisory bulletin based on weather forecast.
- Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

**Practical**

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro advisory.

SAAG232A	Agricultural Journalism	Credits: 03 (2+1)
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- **Overview:** This subject has been designed to impart knowledge of agricultural journalism, communication media, agricultural stories, agricultural information, interviews, Illustrations writing, proofreading, lay outing.

### Objective and Expected Outcome

1. To study agricultural journalism
2. Agricultural information
3. writing, proofreading

### Theory

#### Unit-1

- Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist,
- how agricultural journalism is similar to and different from other types of journalism. Newspapers and magazines as communication media:

#### Unit-2

- Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines:
- Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story:

#### Unit-3

- Types of agricultural stories, subject matter of the agricultural story,
- structure of the agricultural story. Gathering agricultural information:

#### Unit-4

- Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.
- Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories:
- Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

### Practical

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, lay outing. Testing copy with a readability formula. Visit to a publishing office

**7<sup>th</sup> Semester 4<sup>th</sup> Year**  
**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.

Note: In addition to above modules other important modules may be given to the students by SAUs.

S.No.	Paper Code	Title of the module	Credits
1	SAAG401A	Commercial Beekeeping	10 (0+10)
2	SAAG402A	Commercial Sericulture	10 (0+10)
3	SAAG403A	Production Technology for Bioagents and Biofertilizers	10 (0+10)
4	SAAG404A	Commercial Horticulture	10 (0+10)
5	SAAG405A	Floriculture and Landscaping	10 (0+10)
6	SAAG406A	Food Processing	10 (0+10)
7	SAAG407A	Mushroom Cultivation Technology	10 (0+10)
8	SAAG408A	Seed Production and Technology	10 (0+10)
9	SAAG409A	Organic Production Technology	10 (0+10)
10	SAAG410A	Soil, Plant, Water and Seed Testing	10 (0+10)
11	SAAG411A	Poultry Production Technology	10 (0+10)
12	SAAG412A	Agriculture Waste Management	10 (0+10)
13	SAAG413A	<b>(Evaluation of Experiential Learning Programme (ELP))</b>	02 (0+2)

**Evaluation of Experiential Learning Programme (ELP)**

Sr. 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
	<b>Total</b>	<b>100</b>

**8<sup>th</sup> Semester 4<sup>th</sup> Year**  
**Rural Agricultural Work Experience and Agro-industrial Attachment (RAW & AIA)**  
**Paper Code: SAAG414A and SAAG415A**  
**Credits: 20(0+20)**

Sr. No.	Activities	No. of weeks	Credits
1.	General orientation & on campus training by different faculties	1	14
2.	Village attachment	8	
	Unit attachment in Univ. / College. KVK/ Research Station attachment	5	
3.	Plant clinic	2	2
4.	Agro-Industrial attachment	3	4
5.	Project report preparation, presentation and evaluation	1	
<b>Total weeks for RAW &amp; AIA</b>		<b>20</b>	<b>20</b>

- 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.

**RAW & AIA Component-I**  
**Village Attachment Training Programme**

Sr. 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

**RAW & AIA 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 student

**ANNEXURE- A**  
**ELECTIVE COURSES**

**Elective Courses:** A student can select three elective courses out of the following and offered during 4th, 5th and 6th semesters.

Paper Code	Courses	Theory Examinations		Practical Examinations		Theory Examinations
		Univ. Exam.	IA	Univ. Exam.	IA	
SAAG221A	Agribusiness Management	60	15	20	05	3 (2+1)
SAAG222A	Agrochemicals	60	15	20	05	3 (2+1)
SAAG223A	Commercial Plant Breeding	20	05	60	15	3 (1+2)
SAAG224A	Landscaping	60	15	20	05	3 (2+1)
SAAG225A	Food Safety and Standards	60	15	20	05	3 (2+1)
SAAG226A	Biopesticides & Biofertilizers	60	15	20	05	3 (2+1)
SAAG227A	Protected Cultivation	60	15	20	05	3 (2+1)
SAAG228A	Micro propagation Technologies	20	05	60	15	3 (1+2)
SAAG229A	Hi-tech. Horticulture	60	15	20	05	3 (2+1)
SAAG230A	Weed Management	60	15	20	05	3 (2+1)
SAAG231A	System Simulation and Agro-advisory	60	15	20	05	3 (2+1)
SAAG232A	Agricultural Journalism	60	15	20	05	3 (2+1)

**ANNEXURE- B**  
**B.Sc. (Hons.) Agriculture**  
**Scheme of Examinations**  
**1<sup>st</sup> Semester/ 1<sup>st</sup> Year**

	S.N	Paper Code	Subject/Paper	Credits	Theory Examinations			Practical Exam	Total Marks
					Eval.1	Eval.2	End Term Exam		
<b>FIRST YEAR ODD SEMESTER</b>	1	SAAG101A	Principles of Agriculture Meteorology	3 (2+1)	15	15	40	30	100
	2	SACS102A	Information Technology Fundamentals	4(4+0)	20	20	60	Nil	100
	3	SAAG103A	Introductory Agriculture	1(1+0)	20	20	60	Nil	100
	4	SAAG105A	Insect Morphology and Systematics	4(3+1)	15	15	40	30	100
	5	SAAG109A	Introduction to Soil Science	3(2+1)	15	15	40	30	100
	6	SAEL113A	Business Communication-1/Communication Skills	3(3+0)	20	20	60	Nil	100
	7	SAMA149A	Introduction to Statistical Methods	2(2+0)	20	20	60	Nil	100
	8	SAMA163A	Basic of Mathematics*	4(4+0)	20	20	60	Nil	100
	9	SAAG111A	Introductory Biology**	4 (3+1)	15	15	40	30	100
	10		Open Elective	6(6+0)	30	30	40	Nil	100
		<b>Total</b>	<b>34</b>						

Note\* The students from Biology stream will opt for math \*\* students from mathematics and agriculture stream will opt for Biology. \* & \*\*remedial courses

**Scheme of Examination**  
**2<sup>nd</sup> Semester/Ist Year**

	S.N	Paper Code	Subject/Paper	Credits	Theory Examinations			Practical Exam.	Total Marks
					Eval . I	Eval. II	End Term Exam		
<b>FIRST YEAR EVEN SEMESTER</b>	1	SAAG104A	Principles of Agronomy	3 (2+1)	15	15	40	30	100
	2	SAAG106A	Biochemistry	3 (2+1)	15	15	40	30	100
	3	SAAG108A	Fundamentals of Genetics	3 (2+1)	15	15	40	30	100
	4	SAAG110A	Fundamentals of Agricultural Extension Education	3 (2+1)	15	15	40	30	100
	5	SAAG112A	Agricultural Microbiology	3 (2+1)	15	15	40	30	100
	6	SAAG114A	Soil and Water conservation Engineering	2 (1+1)	10	10	30	50	100
	7	SAAG116A	Insect Ecology and Pest Management	3 (2+1)	15	15	40	30	100
	8	SAAG118A	Fundamentals of Rural Sociology and Educational Psychology	2 (2+0)	20	20	60	Nil	100
	9		Open Elective	4(4+0)	30	30	40	Nil	100
		<b>Total</b>	<b>26</b>						

### Scheme of Examination

3<sup>rd</sup> Semester/ 2<sup>nd</sup> Year

SECOND YEAR ODD SEMESTER	S.No.	Paper Code	Subject/Paper	Credits	Theory Examinations			Practical Exam.	Total Mark
					Eval. I	Eval. II	End Term Exam		
					1	SAAG201A	Crop Production Technology-1 (Kharif Crops)		
2	SAAG203A	Fundamentals of Crop Physiology	2 (1+1)	10	10	30	50	100	
3	SAAG205A	Fundamentals Of Horticulture	2 (1+1)	10	10	30	50	100	
4	SAAG207A	Introductory Forestry	2 (1+1)	10	10	30	50	100	
5	SAAG209A	Livestock and Poultry Management	3 (2+1)	15	15	40	30	100	
6	SAAG213A	Renewable Energy and Green Technology	2 (1+1)	10	10	30	50	100	
7	SAAG215A	Fundamentals of Plant Pathology	3 (2+1)	15	15	40	30	100	
8	SAAG217A	Agriculture Finance and Cooperation	2 (2+0)	20	20	60	Nil	100	
9	SAAG219A	Production Technology for ornamental crops,MAP and Landscaping	2 (1+1)	10	10	30	50	100	
10	SADM301A	Disaster Management	3(3+0)	20	20	60	Nil	100	
		<b>Total</b>	<b>23</b>						

### Scheme of Examination

4<sup>th</sup> Semester/ 2<sup>nd</sup> Year

SECOND YEAR EVEN SEMESTER	S.N	Paper Code	Subject/Paper	Credits	Theory Examinations			Practical Exam.	Total Marks
					Eval . I	Eval. II	End Term Exam		
					1	SAAG211A	Crop Production Technology-2 (Rabi Crops)		
2	SAAG202A	Farming System and Sustainable Agriculture	1 (1+0)	20	20	60	Nil	100	
3	SAAG204A	Fundamentals of Plant Breeding	3 (2+1)	15	15	40	30	100	
4	SAAG206A	Production Technology for fruits and Plantation Crops	3 (2+1)	15	15	40	30	100	
5	SAAG208A	Fundamentals of Agricultural Economics	2 (2+0)	20	20	60	Nil	100	
6	SAAG210A	Principles of Seed Technology	3 (2+1)	15	15	40	30	100	
7	SAAG212A	Production Technology for Vegetable and Spice Crops	2(1+1)	10	10	30	50	100	
8	SAAG214A	Farm Machinery and Power	2 (1+1)	10	10	30	50	100	
9	SAAG216A	Agriculture marketing, Trade and Price	3 (2+1)	15	15	40	30	100	
10	SAAG218A	Problematic Soils and their management	1(1+0)	20	20	60	Nil	100	
11	SAAG220A	Agriculture Informatics	2(2+0)	20	20	60	Nil	100	
12		Elective	3(2+1)	15	15	40	30	100	
		<b>Total</b>	<b>27</b>						

**Scheme of Examination**  
**5<sup>th</sup> Semester/ 3<sup>rd</sup> Year**

S. N	Paper Code	Subject/Paper	Credits	Theory Examinations			Practical Exam.	Total Marks	
				Eval. I	Eval.II	End Term Exam			
THIRD YEAR ODD SEMESTER	1	SAAG301A	Principles of Integrated Disease Management	2(1+1)	10	10	30	50	100
		SAAG303A	Pests of Crops and Stored Grains and their management	3(2+1)	15	15	40	30	100
	2	SAAG305A	Crop Improvement-1(Kharif Crops)	2(1+1)	10	10	30	50	100
	3	SAAG307A	Geoinformatics, Nanotechnology and Precision Farming	2(1+1)	10	10	30	50	100
	4	SAAG309A	Practical Crop Production-1 (Kharif Crops)	2(0+2)	Nil	Nil	Nil	100	100
	5	SAAG311A	Rain- fed Agriculture and Watershed Management	2 (1+1)	10	10	30	50	100
	6	SAAG313A	Diseases of Field and Horticultural Crops and their management-II	3 (2+1)	15	15	40	30	100
	7	SAAG315A	Management of Beneficial Insects	2 (1+1)	10	10	30	50	100
	8	SAAG317A	Crop Improvement-II	2 (1+1)	10	10	30	50	100
	9	SAAG319A	Practical Crop Production-II Rabi Crops	2(0+2)	Nil	Nil	Nil	100	100
10		Elective	3(2+1)	15	15	40	30	100	

**Scheme of Examination**  
**6<sup>th</sup> Semester/ 3<sup>rd</sup> Year**

S.No.	Paper Code	Subject/Paper	Credits	Theory Examinations			Practical Exam.	Total Marks	
				Eval I	Eval II	End Term			
THIRD YEAR EVEN SEMESTER	1	SAAG302A	Manures, Fertilizers and Soil Fertility Management	3(2+1)	15	15	40	30	100
	2	SAAG304A	Diseases of Field and Horticultural Crops and their management-I	3(2+1)	15	15	40	30	100
	3	SAAG306A	Entrepreneurship Development and business communication	2(2+0)	20	20	60	Nil	100
	4	SAAG308A	Intellectual Property Rights	1(1+0)	20	20	60	Nil	100
	5	SAAG310A	Practical Crop Production-II (Rabi Crops)	2 (0+2)	Nil	Nil	Nil	100	100
	6	SAAG312A	Protected Cultivation and Secondary Agriculture	2 (1+1)	10	10	30	50	100
	7	SAAG314A	Post-harvest management and Value addition of Fruits and Vegetables	2(1+1)	10	10	30	50	100
	8	SAAG316A	Principles of Organic Farming	2 (1+1)	10	10	30	50	100
	9	SAAG318A	Farm Management, Production. Resource Economics	2 (1+1)	10	10	30	50	100
	10		Elective	3 (2+1)	15	15	40	30	100
		Total	22						

**Scheme of Examination  
7th Semester/ 4rd Year  
Modules for Skill Development and Entrepreneurship**

S.N	Paper Code	Subject/Paper	Credit	Theory Examinations			Practical Exam.	Total Marks
				Eval . I	Eval. II	End Term Exam		
1	SAAG401A	Commercial Beekeeping	10 (0+10)	Nil	Nil	Nil	100	100
2	SAAG402A	Commercial Sericulture	10(0+10)	Nil	Nil	Nil	100	100
4	SAAG44A	Production Technology for Bio- agents and Bio-fertilizers	10(0+10)	Nil	Nil	Nil	100	100
4	SAAG404A	Commercial Horticulture	10 (0+10)	Nil	Nil	Nil	100	100
5	SAAG405A	Floriculture and Landscaping	10 (0+10)	Nil	Nil	Nil	100	100
6	SAAG406A	Food Processing	10 (0+10)	Nil	Nil	Nil	100	100
7	SAAG407A	Mushroom cultivation Technology	10 (0+10)	Nil	Nil	Nil	100	100
8	SAAG408A	Seed Production Technology	10 (0+10)	Nil	Nil	Nil	100	100
9	SAAG409A	Organic Production Technology	10 (0+10)	Nil	Nil	Nil	100	100
10	SAAG410A	Soil, Plant, Water and seed Testing	10 (0+10)	Nil	Nil	Nil	100	100
11	SAAG411A	Poultry Production Technology	10 (0+10)	Nil	Nil	Nil	100	100
12	SAAG412A	Agriculture Waste Management	10 (0+10)	Nil	Nil	Nil	100	100
13	SAAG413A	Experiment Learning Programme (Compulsory)	2(0+2)	-	-	-	100	100
<b>Total</b>			<b>22</b>					

Note: A student has to register 20 credits opting for any two modules 10 (0+10) credits each (Total 20 Credits) from the above mentioned modules. In addition to this the module Experimental Learning Programme (EPL) of credits 2 is compulsory for all students.

**Evaluation of Experiential Learning Programme (ELP)**

S.No.	Parameters	Max. Marks
1	Project Planning and Learning	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
	<b>Total</b>	<b>100</b>

**Scheme of Examination**  
**8<sup>th</sup> Semester/ 4<sup>th</sup> Year**

FOURTH YEAR EVEN SEMESTER	S.N	Paper Code	Subject/Paper	Credit Hrs	Theory Examinations			Practical Exam.	Total Marks
					Eval. I	Eval. II	End Term Exam		
	1	SAAG414A	Rural Agriculture Work Experience and Agro industries Attachment- <b>Component-I</b>	14 (0+14)	Nil	Nil	Nil	100	100
	2.	SAAG415A	Rural Agriculture Work Experience and Agro industries Attachment- <b>Component-II</b>	6 (0+6)	Nil	Nil	Nil	100	100
	<b>Total</b>			<b>20</b>					

<b>Rural Agriculture Work Experience and Agro-Industrial Attachment (RAWE &amp; AIA)</b>	
Activities	No. of Weeks
General Orientation and on campus Trainings by faculties	1 Week
Village Attachment	8 Weeks
Unit Attachment in Univ./College/KVK/Research Station etc.	5 Weeks
Plant Clinic	2 Weeks
Agro-industrial attachment	3 Weeks
Project Report preparation, presentation and evaluation	1Week

Rural Agriculture Work Experience. (RAWE)

### **Component-I**

Village Attachment Training Programme

S.No.	Activity	Duration
1	Orientation and Survey of Village	1Week
2	Agronomical Interventions	1Week
3	Plant Protection Interventions	1Week
4	Soil Improvement Interventions (Soil Sampling and Testing)	1Week
5	Fruit and Vegetable Production Interventions	1Week
6	Food Processing and Storage Interventions.	1Week
7	Animal Production Interventions	1Week
8	Extension and Transfer of Technology Activities	1Week

### **Rural Agriculture Work Experience (Agro. Industry Attachments)**

#### **Component -II**

- Agro-Industrial Attachment: The students will be attached with the agro- industries for a period of 3 weeks.
- Industries Include Seed/Sapling Production, Pesticide industries, 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 industry
- Contribution of the industry towards environment
- Learning business network including outlets of the industry

- Skill development in all crucial tasks of industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students.

## **1. INTERNSHIP/INDUSTRY TRAINING**

Every student of B.Sc.(Hons.) Agriculture shall be required to undergo Rural agricultural Work Experience and Agricultural Industrial Attachment (RAW & AIA) internship for twenty weeks during 8th semester. The work done by the candidate during the internship shall be submitted to the concerned teachers. The practical/internship report evaluation shall be done by the concerned teachers.