

## M.Sc. (Ag.) Horticulture

1 <sup>st</sup> Semester			Evaluation Marks			
Code No.	Course Title	Credit Hours	Mid Term (Internal)	Practical (External)	End term/Final (External)	Total
HORT 501	Production Technology of Winter season Vegetables	3(2+1)	20	30	50	100
HORT 502	Landscaping and ornamental Gardening	3(2+1)	20	30	50	100
HORT 503	Tropical and Dry Land Fruit Production	3(2+1)	20	30	50	100
*HORT 511	Fruit Technology (Special Paper)	4(3+1)	20	30	50	100
AST 501	Experimental Designs	3(2+1)	20	30	50	100
	<b>Total Credit</b>	<b>12</b>				
2 <sup>nd</sup> Semester			Evaluation Marks			
HORT 504	Production technology of warm season vegetables	3(2+1)	20	30	50	100
HORT 505	Subtropical and temperate fruit production	3(2+1)	20	30	50	100
HORT 506	Commercial Floriculture	3(2+1)	20	30	50	100
*HORT 512	Protected Cultivation of Horticultural Crops	4(3+1)	20	30	50	100
AST 503	Computer Application in Agriculture	2(1+1)	20	30	50	100
	<b>Total Credit</b>	<b>11</b>				
3 <sup>rd</sup> Semester			Evaluation Marks			
HORT 507	Propagation and Nursery Management of Horticulture crops	3(2+1)	20	30	50	100
HORT 508	Production Technology of Plantation Medicinal, Aromatic and Species crops	3(2+1)	20	30	50	100
HORT 509	Breeding of Horticulture	3(1+1)	20	30	50	100

	Crops					
*HORT 513	Seed Production Tech. of Vegetable Crops	4(3+1)	20	30	50	100
	<b>Total Credit</b>	<b>09</b>				
<b>4<sup>th</sup> Semester</b>			<b>Evaluation Marks</b>			
HORT 510	Post Harvest Technology for Horticultural Crops	3(2+1)	20	30	50	100
HORT 516	Master Seminar	1(0+1)	-	-	-	100
HORT 517	Master Research (Thesis)	20	Satisfactory/Unsatisfactory			
<b>OR</b>						
*HORT 514	Advance in Horticulture	4(3+1)	20	30	50	100
*HORT 515	Production Technology of under utilize Sub-Tropical crops	4(3+1)	20	30	50	100
	<b>Grand total credit hours</b>	<b>56</b>				

**NOTE: \* These courses are in lieu of thesis**

## I<sup>st</sup> Semester

### **HORT 501 PRODUCTION TECHNOLOGY OF WINTER SEASON VEGETABLE CROPS**

**3(2+1)**

#### **Theory**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of :-

**Unit-I :-** Potato

**Unit-II :-** Cole crops: cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels sprout.

**Unit-III :-** Root crops: carrot, radish, turnip and beetroot

**Unit IV-** Bulb crops: onion and garlic.

**Unit-V :-** Peas and broad bean, green leafy cool season vegetables.

#### **Practical**

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economic; Experiments to demonstrate the role of mineral elements, plant growth substances and herbicides; study of physiological disorders; preparation of cropping scheme for commercial farms; visit to commercial greenhouse/polyhouse. Research project related to vegetable crops.

## 1<sup>st</sup> Semester

### **HORT 502 LANDSCAPING AND ORNAMENTAL GARDENING 3(2+1)**

#### **Theory**

#### **UNIT-I**

Landscape designs types of gardens, English, Mughal, Japanese, Persian, Spanish, Italian, Vanams, Buddha garden; Styles of garden, formal, informal and free style gardens.

#### **UNIT II**

Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporates.

#### **UNIT-III**

Garden plant components, arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, cacti and succulents, herbs, annuals, flower borders and beds, ground covers, carpet beds, bamboo groves; Production technology for selected ornamental plants.

#### **UNIT-IV**

Lawns, Establishment and maintenance, special types of gardens, vertical garden, roof garden, bog garden, sunken garden, rock garden, clock garden, colour wheels, temple garden, sacred groves.

#### **UNIT-V**

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.

#### **Practical**

Selection of ornamental plants, practices in preparing designs for home gardens, industrial gardens, institutional gardens, corporate, avenue planting, practices in planning and planting of special types of gardens, burlapping, lawn making, planting herbaceous and shrubbery borders, project preparation on landscaping for different situations, visit to parks and botanical gardens, case study on commercial landscape gardens.

## 1<sup>st</sup> Semester

**HORT 503 TROPICAL AND DRY LAND FRUIT PRODUCTION 3(2+1)**

### **Theory**

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, pest and diseases management, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri. Export Zones (AEZ) and industrial support.

**UNIT-I :-** Mango and Banana

**UNIT-II :-** Citrus and Papaya

**UNIT-III :-** Guava, Sapota and Jackfruit

**UNIT-IV :-** Pineapple, Annonas and Avocado

**UNIT-V :-** Aomla, Phalsa and Ber, minor fruits of tropics

### **Practical**

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical and arid zone orchards, Project preparation for establishing commercial orchards.

**Ist Semester**  
**Special Paper**

**HORT 511 FRUIT TECHNOLOGY**

**4(3+1)**

**Unit-I :**

History, present position and future scope of fruit and vegetables preservation industries in India General principles of fruit and vegetables preservation

**Unit-II :**

Canning and bottling of fruit and vegetables, brief history of scientific canning equipment for home canning and commercial production, important consideration for laying out of canny Canning of important fruits, vegetables, spoilage in canned fruits and vegetables

**Unit-III:**

Fruits and vegetables juices, unfermented beverages [sweetened and unsweetened], principles of preservation, home and commercial scale equipment for juices, preparation and preservation of juices, squashes and Cardials from Citrus fruits, Mango, Phalsa, Jamun, Grape, Pomegranate, Tomato etc. Fruit juice concentrates and their general method of preparation

**Unit-IV :**

Jams, Jellies and Marmalades, role of pectin-sugar and acid in jelly formation, general method of preparation of jams, jellies and marmalades, use of jelly meter etc. Equipment for home and commercial production.

**Unit-V :**

Pickles, sauces, chutney and Vinegar, Potato chips general principles equipment and method of preparation, preserve candy and canes fruits, general principles and method of preparation of byproduct from fruit and vegetables waste in home and commercial production and sun drying and dehydration of fruit and vegetables, equipment and methods.

**Practical**

- (1) List of important equipments for fruit and vegetable preservation .
- (2) Preparation of Jam, Jelly, Marmalade and Pickles (Mango, Lime and Mix Veg.)
- (3) Preparation of Beverages (RTS, Squash, Nectar, Syrup and Barley Water)
- (4) Preparation of preserve and candy (Aonla, Bael and Karaunda).
- (5) Preparation of Tomato products (Sauce , Ketchup and chutney)
- (6) Preparation of Potato Chips and canning of Pea

## 2<sup>nd</sup> Semester

### **HORT 504 PRODUCTION TECHNOLOGY OF WARM SEASON VEGETABLES**

**3(2+1)**

#### **Theory**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids. sowing/planting times and methods, seed rare and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management plant protection measures, economics of crop production and seed production of :

**Unit-I :-** Tomato, eggplant, hot and sweet pepers

**Unit-II:-** Okra, beans, cowpea and clusterbean

**Unit-III :-** Cucurbitaceous crops

**Unit-IV:-** Tapioca and sweet potato

**Unit-V:-** Green Leafy Warm season vegetables.

#### **Practical**

Cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics; study of physiological disorders and deficiency of mineral elements. preparation of cropping schemes for commercial farms; experiments to demonstrate the role of mineral elements, physiological disorders; plant growth substances and herbicide; seed extraction techniques; identification of important pests and diseases and their control; maturity standards; economics of warm season vegetable crops.

## 2<sup>nd</sup> Semester

### **HORT 505 SUBTROPICAL AND TEMPERAT FRUIT PRODUCTION 3(2+1)**

#### **Theory**

Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems. cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and development, abiotic factors limiting production. physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, industrial and export potential, Agri. Export Zone (AEZ) and industrial support.

#### **Crops**

**Unit-I** :- Apple, pear, quince, grapes

**Unit-II** :- Plums, peach, apricot, cherries, hazelnut

**Unit-III** :- Litchi, loquat, persimmon, kiwifruit, strawberry

**Unit-IV**:- Nuts-walnut, almond, pistachio, pecan

**Unit-V**:- Minor fruits-mangosteen, carambola, bael, wood apple, fig, jamun, rambutan pomegranate.

#### **Practical**

Identification of important cultivars, observations on growth and development, practices in growth regulation, malady diagnosis, analyses of quality attributes, visit to tropical, subtropical, humid tropical and temperate orchards, Project preparation for establishing commercial orchards.



## 2<sup>nd</sup> Semester

### **HORT 506 COMMERCIAL FLORICULTURE**

**3(2+1)**

#### **Theory**

#### **UNIT-I**

Scope of cut and loose flowers in global trade, Global Scenario of cut and loose flower production. Varietal wealth and diversity, area under cut and loose flowers and production problems in India-Patent rights, nursery management media for nursery, special nursery practices.

#### **UNIT-II**

Growing environment, on cultivation of cut and loose flower, soil it requirements, field preparation, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO<sub>2</sub> on growth and flowering.

#### **UNIT-III**

Flower production – water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

#### **UNIT-IV**

Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

#### **UNIT-V**

Cut flower standards and grades, harvest indices, harvesting techniques. Post-harvest handling. Methods of delaying flower opening, prolonging self life, Pre-cooling, pulsing, packing, Storage & transportation, marketing, export potential, institutional support. Agri. Export Zones.

Crops: Rose, chrysanthemum, carnation, gerbera, gladioli. tuberose, orchids, anthurium, aster. liliiums, as cut flower nyctanthes, jasmines, marigold, crosandra, celosia, gamphrena as loose flower.

#### **Practical**

Botanical description of varieties, progagation techniques, mist chamber operation, training and puruning techniques, practices in manuring, dirp and fertigation, foliar nutrition, growth regulator application, pinching, disbudding. staking, harvesting techniques, post-harvest handling, cold chain, project preparation for regionally important cut and loose flowers, visit to commercial flower units and case study.

**2<sup>nd</sup> Semester**  
**Special Paper**

**HORT 512 PROTECTED CULTIVATION OF HORTICULTURAL CROPS**

**4(3+1)**

**Theory**

**Unit-I**

Importance and scope of protected cultivation, world scenario Indian situation present and future scope. Principles used in protected cultivation, energy management, low cost structures;

**Unit-II**

Regulatory structures used in protected structure types of greenhouse/polyhouse/nethouse, hot beds, cold frames, effect of environmental factors viz. temperature, light. CO<sub>2</sub> and humidity on growth of different vegetables, flowers and fruits. manipulation of CO<sub>2</sub> light and humidity and temperature for production of horticultural crops installation of micro irrigation and fertilization.

**Unit-III**

Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

**Unit IV**

Regulation of flowering and fruiting in horticultural crops. technology for raising tomato, sweet pepper, cucumber, gerbera, rose, chrysanthemum and straw berry in protected structures training and staking in protected crops, varieties and hybrids suitable for growing in protected structures.

**Unit-V**

Problem of growing horticultural crops in protected structures and their remedies, insect and disease management in protected structures;

**Practical**

Study of various types of structures, methods to control temperature, CO<sub>2</sub> and light, media, training and pruning, fertigation and nutrient management; control of insect-pests and diseases in greenhouse; economics of protected cultivation, visit to established green/poly house/net house/shade house in the region.

### **3<sup>rd</sup> Semester**

## **HORT 507 PROPAGATION AND NURSERY MANAGEMENT FOR**

### **HORTICULTURAL CROPS**

**3(2+1)**

#### **Theory,**

#### **Unit-I**

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixes, polyembryony, chimeras. Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth.

#### **Unit-II**

Seed quality, treatment, packing, storage, certification, testing. Asexual propagation-rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hotbeds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering — principle and methods.

#### **Unit-III**

Budding and grafting — selection of elite mother plants, methods. Establishment of bud wood bank, stock, scion and inter stock relationship-incompatibility. Rejuvenation through top working — Progeny orchard and scion bank.

#### **Unit-IV**

Micro-propagation-principles and concepts, commercial exploitation in horticultural crops. Techniques-in vitro clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture. Hardening, packing and transport of micro-propagules.

#### **Unit-V**

Nursery-types, structures, components, planning and layout. Nursery management practices for healthy propagule production.

#### **Practical**

Anatomical studies in rooting of cutting and graft union, construction of propagation structures, study of media and PGR. Hardening –case studies, micro propagation, explant preparation, media preparation, culturing - in vitro clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct organogenesis, direct and indirect embryogenesis, micro grafting, hardening. Visit to TC labs and nurseries.

**3<sup>rd</sup> Semester**

**HORT 508 PRODUCTION TECHNOLOGY OF PLANTATION MEDICINAL  
AROMATIC AND SPECIES CROPS**

**3(2+1)**

**Theory**

**Unit- I :**

Importance and scope of aromatic, medicinal, aromatic and Species crops in India and its area and distribution. Future prospects, classification of plantation, medicinal, aromatic, Species crops.

**Unit-II :**

Production technology of plantation crops like, Coconut, Cashew nut, Tea, Coffee and Cocoa.

**Unit- III :**

Cultivation of medicinal crops like Rauvolfia, Dioscorea, Aloe vera, Safed musli, Stevia, Isabgol, Ashwagandha.

**Unit- IV :**

Cultivation of Aromatic crops like Mentha, Javacitronella, Khus, Ocimum, , Lemon grass, Geranium, Palmarosa and Rose.

**Unit-V :**

Production technology of Species crops like Turmeric, Zinger, Cumin, Coriander, Fennel, Black Paper, Cardamon (Large and small).

**Unit-VI :**

Different method of distillation of medicinal and aromatic crops, problems of distillation and their solution. Marketing of plantation, medicinal, aromatic and species crops.

**Practical :**

1. Identification of plantation, medicinal, aromatic and species, crops.
2. Study of propagation techniques of plantation, medicinal, aromatic and species, crops.
3. Study of cost of production of Rauvolfia, Alovera, Safed Musli, Mentha, Turmeric, Ginger, Coriander, Coconut, Cashew, Tea, Coffee.
4. Study of different method of distillation of medicinal and aromatic crops.
5. Visit of distillation plant and institute related to plantation, medicinal, aromatic and species, crops.

### 3<sup>rd</sup> Semester

#### **HORT 509 BREEDING OF HORTICULTURAL CROPS**

3(2+1)

##### **Theory**

Origin, botany, taxonomy, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, 'mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, issue of patenting, PPVFR act achievement and future trust in following selected crops,.

##### **Unit-I**

Mango, papaya, banana, grape and citrus fruits.

##### **Unit- II**

Potato, tomato, brinjal, hot pepper and sweet pepper.

##### **Unit-II**

Okra, Pea and beans.

##### **Unit-IV**

Gourds, melons, pumpkins and squashes

##### **Unit-V**

Cabbage, cauliflower, carrot beetroot, radish

##### **Practical**

Selection of desirable plants from breeding population, observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations; induction of flowering, palynological studies, selfing and crossing techniques in horticulture crops; hybrid seed production of vegetable crops in bulk, screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops, demonstration of sib-mating and mixed population; Visit to breeding blocks.

**3<sup>rd</sup> Semester**  
**Special Paper**

**Hort-513 SEED PRODUCTION TECHNOLOGY OF VEGETABLE CROPS 4(3+1)**

**Theory**

**Unit – I**

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India

**Unit – II**

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behavior, seed development and maturation; methods of hybrid seed production.

**Unit – III**

Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standard; seed act and law enforcement, plant quarantine and quality control.

**Unit –IV**

Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packing (containers/packets), storage and cryopreservation of seeds, synthetic seed technology.

**Unit – V**

Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra, vegetatively propagated vegetables.

**Practical**

Seed sampling, seed testing (genetic purity, seed viability, seedling vigour, physical purity) and seed health testing; releasing and notification procedures of varieties; floral biology; roughing of off-type; methods of hybrid seed production in important vegetables and spice crops; seed extraction techniques; handling of seed processing and seed testing equipment; seed sampling; testing of vegetable seed purity, germination, vigour and health, visit processing units, seed testing laboratory and seed production farms

## 4<sup>th</sup> Semester

### HORT 510 POST HARVEST TECHNOLOGY OF HORTICULTURAL CROPS

3(2+1)

#### **Theory**

##### **Unit-I**

Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration.

##### **Unit-II**

Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest losses horticultural crops, pre-cooling. Spoilage, microbial and biochemical physical injuries and disorders.

##### **Unit-III**

Treatments prior to transportation, viz. grading, precoding chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage-ventilated, refrigerated, MAS, CA storage zero energy cool chamber, hypobaric storage.

##### **Unit-IV**

Packing methods and transport, principles and methods of preservation, food processing, canning preparation of fruit juices.

##### **Unit-V**

Dried and dehydrated products, nutritionally enriched products, fermented beverages, packaging technology management of processing waste, food safety standards.

#### **Practical**

Analyzing maturity stages of commercially important horticultural crops, improved packing and storage of important horticultural commodities, physiological loss in weight of fruits and vegetables, estimation of transpiration, respiration rate, ethylene release and study of vase life extension in cut flower using chemicals. estimation of quality characteristics in stored fruits and vegetables, cold chain management visit to cold storage and CA storage units, visit to fruit and vegetable processing units, project preparation, evaluation of processed horticultural products.

**4<sup>th</sup> Semester  
Special Paper**

**HORT 514 ADVANCES IN HORTICULTURE**

**4(3+1)**

**Theory**

**Unit-I :**

Introduction and importance, mechanization of Nursery. Micro Propagation of Horticulture, Crops Advantages and limitations. Types of culture (Seed, embryo, organ, callus).

**Unit II :**

Advances made in root stocks Development of root stocks for biotic and abiotic stress

**Unit III :**

Advances in irrigation system Advantage and disadvantage of drip irrigation, sprinkler and rain gun.

**Unit IV :**

Canopy management of Tropical and Subtropical fruit crops like Mango, Guava, Grapes, Ber and Beal.

**Unit V:**

Special problem of fruit crops and their control (Mango, Guava, Papaya, Grapes, Pine apple and Apple). High density or herding in fruits crops

**Practical :**

1. Identification and use of equipments in tissue culture laboratory.
2. Sterilization technique of media.
3. Identification and application of tools and equipment related to micro irrigation system and canopy management.
4. Identification of special problems of fruit crops.



**4<sup>th</sup> Semester  
Special Paper**

**HORT 515 PRODUCTION TECHNOLOGY OF UNDER UTILIZE SUB-TROPICAL FRUITS**

**4(3+1)**

**Theory**

**Unit I :**

Importance and scope of under utilize fruits in India. Distribution and description of under utilize fruits.

**Unit II :**

Production technique of under utilize sub-tropical fruits like Beal, Carambola, Custard apple, Wood Apple, Tamarind, Lasora, Barbadas cherry, Chirounji, Jamun, Falsa, Fig, Mulberry, Karounda, Barhal and Amra.

**Unit III :**

Propagation technique of under utilize fruits sexual and asexual including micro propagation.

**Unit IV :**

Problem of under utilize fruits and their remedies.

**Unit V:**

Marketing, Post harvest management and storage of under utilize fruits.

**Practical :**

1. Identification of under utilize fruits.
2. Propagation of under utilize fruits.
3. Filling and Lifting of poly bags
4. Packaging of sampling.
5. Visit of Research centers working on under utilize fruits.

**2<sup>nd</sup> Semester**  
**Common Course for M.Sc. (Ag.)**

**AST 502 COMPUTER APPLICATION IN AGRICULTURE**

**2(1+1)**

**Theory**

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. 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. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smart phone Apps in Agriculture for farm advises, market price, post harvest management etc; 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.

**Practical**

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management.

Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document. MS-EXCEL. - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CmpSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

**I<sup>st</sup> Semester**  
**M.Sc. (Ag.) Agricultural Statistics**

**AST 501 EXPERIMENTAL DESIGNS**

**3(2+1)**

**Theory**

**Unit-I**

Classification tabulation and graphical representation of data. Box-plot Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation.

**Unit II :**

Discrete and continuous probability distribution: Binomial, Poisson, Normal distribution. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on Normal, chi-square. t and F distributions. Large sample theory.

**Unit III :**

Introduction to theory of estimation and confidence-intervals. Correlation and regression, Simple and multiple linear regression model, estimation of parameters. predicted values and residuals, correlation coefficient partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient. Test of significance of correlation coefficient and regression coefficients, coefficient of determination.

**Unit IV**

Need for designing of experiments, characteristics of a good design. Basic principles of designs, randomization, replication and local control.

**Unit V**

Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin square design, missing plot techniques, split plot design.

**Unit VI**

Sampling techniques - Planning of survey, method of data collection. questionnaire v/s schedule. Problems of sampling frame, choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, confidence interval, determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation. Non sampling error source and classification,

**Practical**

On the topic listed on the theory syllabus.

