## Semester VI

| Course No. | Courses | Credit | | |
|---|---|---|---|---|
| | | **T** | **P** | **Total** |
| **A)** | **Core Course** | | | |
| AGRO 3611 | Practical Crop Production-II(Rabi crops) | 0 | 1 | 1 |
| AGRO 3612 | Geo-informatics and Nano-technology and Precision Farming | 1 | 1 | 2 |
| AHDS 364 | Sheep Goat and Poultry Production | 1 | 1 | 2 |
| ECON 365 | Farm Management, Production and Resource Economics | 1 | 1 | 2 |
| ENGG 364 | Protected Cultivation and secondary Agriculture | 1 | 1 | 2 |
| ENTO 365 | Management of Beneficial Insects | 1 | 1 | 2 |
| FST 362 | Principles of Food Science and Nutrition | 2 | 0 | 2 |
| GPB 366 | Crop Improvement – II (Rabi crops) | 1 | 1 | 2 |
| HORT 366 | Post-harvest Management and Value Addition of Fruits and Vegetables | 1 | 1 | 2 |
| PATH 365 | Diseases of Field and Horticultural Crops and their Management-II | 2 | 1 | 3 |
| | **Subtotal** | **11** | **9** | **20** |
| **B)** | **Elective courses** | | | |
| ELE AGM 361 | System Stimulation and Agro-advisory | 2 | 1 | 3 |
| ELE HORT 368 | Hi tech Horticulture | 2 | 1 | 3 |
| ELE HORTI367 | Landscaping | 2 | 1 | 3 |
| ELE SSAC 364 | Agrochemicals | 2 | 1 | 3 |
| | **Subtotal** | **2** | **1** | **3** |
| | **Total (A+B)** | **13** | **10** | **23** |

| ***Course :*** | *AGRO 3611* | | ***Credit:*** | *2(0+2)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Practical Crop Production-II(Rabi crops)* | | | | |

## Syllabus

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

(To get practical oriented knowledge to the student, 2 R area per student will be allotted for raising *rabi*crops of the region. The student has to raise the crop from sowing to harvesting threshing, drying, winnowing, storage and preparation of produce for marketing. Also he has to study the cost of cultivation, net return per student as well as per team of a group of students.*)

**(Note : * new inclusion)**

## Teaching Schedule

**Practical**

| Experiment | Topic |
|---|---|
| 1 | Introduction, aims and objectives of practical crop production – Allotment of plot and its history. |
| 2 | Study of seed production of *rabi* crops |
| 3 | Study of mechanization and resource conservation of *rabi* crops |
| 4 | Study of physical and chemical properties of the allotted plot to the students. |
| 5 | Study of package of practices for growing *rabi* crop (timely, late and rainfed). |
| 6 | Preparation of calendar of operation for *rabi* crop. |
| 7 | Study of preparatory, secondary tillage and seed bed preparation for *rabi* crop. |
| 8 | Sowing and seed treatment of *rabi* crop. |
| 9 | Study of integrated nutrient management of *rabi* crop. |
| 10 | Study of water management to *rabi* crop. |
| 11 | Determination of germination/emergence count of *rabi* crop. |
| 12 | Study of growth and yield contributing characters of *rabi* crop. |
| 13 | Study of interculturing and weed management in *rabi*crop. |
| 14 | Study of integrated insect pest and diseases management in *rabi* crop |
| 15 | Study of crop maturity signs, harvesting of *rabi* crop |
| 16 | Threshing, drying, winnowing, storage and preparation of produce for marketing of *rabi* crop. |

| Experiment | Topic |
|---|---|
| 17 | Study of cost of cultivation and working out net returns per student |
| 18 | Study of post harvest technology of *rabi* crop |
| 19 | Summary report of practical crop production |
| 20 | Study of weekly weather record for *rabi*season. |

**Note :**
To get practical oriented knowledge to the students, 40 R area per batch will be allotted for raising *rabi*crop of the region, viz., land preparation, sowing to harvesting, threshing, drying, winnowing, storage and preparation of produce for marketing. Study of cost of cultivation, net return and B:C ratio**.**

## Suggested Readings:


1. *Modern technique of raising field crops by Chiddasingh*
2. *Agronomy of field crop by S.R. Reddy*
3. *Hand book of Agriculture, ICAR New Delhi*


| ***Course :*** | *AGRO 3612* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Geo-informatics and Nano-technology and Precision Farming* | | | | |

## Syllabus

**Theory :**Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

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

## Teaching Schedule

### a) Theory

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Precision agriculture: concepts and techniques; their issues and concerns referencefor Indian agriculture | 4 |
| 2 | Geo-informatics system- Definition, concepts, tool and techniques; their use in Precision farming. | 7 |
| 3 | Crop discrimination and Yield monitoring | 4 |
| 4 | soil mapping; fertilizer recommendation using geospatial technologies | 5 |
| 5 | Spatial data and their management in GIS | 8 |
| 6 | Remote sensing concepts and application in agriculture | 8 |
| 7 | Image processing and interpretation | 8 |
| 8 | Global positioning system (GPS), components and its functions | 9 |
| 9 | Introduction to crop Simulation Models | 5 |
| 10 | Uses of crop simulation models for optimization of Agricultural Inputs | 7 |
| 11 | STCR approach for precision agriculture | 5 |
| 12 | Nanotechnology- Definition, concepts and techniques | 7 |
| 13 | Brief introduction about nanoscale effects, nano-particles | 5 |
| 14 | Nano-pesticides, nano-fertilizers, nano-sensors | 7 |
| 15 | Use of nanotechnology in seed & water for scaling-up farm productivity. | 6 |
| 16 | Use of nanotechnology in fertilizer & plant protection for scaling up farm productivity | 5 |

### b) Practical

| Experiment | Topic |
|---|---|
| 1 | Introduction to GIS software, spatial data creation and editing |
| 2 | Introduction to image processing software |
| 3 | Visual and digital interpretation of remote sensing image by software |
| 4 | Generation of spectral profiles of different objects |
| 5 | Supervised and unsupervised classification and acreage estimation |
| 6 | Multispectral remote sensing for soil mapping |
| 7 | Soil fertility map by GIS |
| 8 | Creation of productivity and management zone by GIS |

| | |
|---|---|
| 9 | VRT technique for fertilizer recommendation |
| 10 | STCR technique for fertilizer recommendation for targeted yield |
| 11 | Calculation of crop stress geospatial technique |
| 12 | Agricultural Survey by GPS and DGPS |
| 13 | Formulation and characterization of nanoparticles |
| 14 | Applications of nanoparticles in agriculture |
| 15 | Projects related by precision farming. |

## Suggested Readings:


1) GIS : Fundamentals, Applications & Implementations – Dr. K Elangovan New India publishing Agency, New Delhi.
2) *Remote sensing , GIS and wet land management - ErTasneemAbbasi& Prof. S.A. Abbasi*


| | | | | | |
|---|---|---|---|---|---|
| ***Course :*** | *GPB 366* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
| ***Course title:*** | *Crop Improvement- II (Rabi crops)* | | | | |

## Syllabus

### Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters; 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); 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, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

# Teaching Schedule

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Cereals –Wheat, oat and barley - Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 10 |
| 2 | Pulses –Chickpea- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 8 |
| 3 | Oilseeds –Sunflower and Safflower- Centers of origin, Distribution of species, Wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 10 |
| 4 | Oilseeds –Linseed, Rapeseed and Mustard- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 8 |
| 5 | Fodders –Napier, Bajra, Sorghum, Maize and Berseem- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 5 |
| 6 | Cash -Sugarcane - Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 6 |
| 7 | Vegetable-Potato- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 5 |
| 8 | Vegetable-Field pea- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | 5 |
| 9 | Horticultural crops-Mango, Aonla and Guava- Centers of origin, Distribution of species, wild relatives, Floral biology, Major breeding objectives and procedures including conventional and | 8 |

| Lecture | Topic | Weightage (%) |
|---|---|---|
| | modern innovative approaches for development of hybrids and varieties for yield, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional) | |
| 10-11 | Plant genetic resources, its utilization and conservation | 8 |
| 12 | Adaptability and stability | 5 |
| 13- 14 | Hybrid seed production technology in Rabi crops -Sunflower, Safflower, Castor, Rabi Sorghum | 12 |
| 15 - 16 | Ideotype concept and climate resilient crop varieties for future- Wheat, Rice, Maize, Sorghum and Cotton | 10 |
| | **Total** | **100** |

***b) Practical***

| Experiment | Exercise |
|---|---|
| 1 | Emasculation and hybridization techniques in wheat, oat & barley |
| 2 | Emasculation and hybridization techniques in chickpea & lentil |
| 3 | Emasculation and hybridization techniques in field pea, rapeseed & mustard |
| 4 | Emasculation and hybridization techniques in sunflower |
| 5 | Emasculation and hybridization techniques in potato &berseem |
| 6 | Emasculation and hybridization techniques in sugarcane & cowpea |
| 7 | Emasculation and hybridization techniques in safflower |
| 8 | Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods |
| 9 | Study of field techniques for seed production and hybrid seeds production in Rabi crops |
| 10 | Estimation of heterosis, inbreeding depression and heritability |
| 11 | Layout of field experiments |
| 12 | Study of quality characters, study of donor parents for different characters |
| 13 | Visit to seed production plots |
| 14 | Visit to AICRP plots of Safflower & Chickpea |
| 15 | Visit to AICRP plots of Sunflower & Rabi sorghum |

# Suggested Readings:

| Sr. No | Title of Book | Author/Authors | Publisher |
|---|---|---|---|
| 1. | Crop Breeding and Biotechnology | HariHar Ram | KalyaniPublication New Delhi. |

| | | | |
|---|---|---|---|
| 2. | Breeding of Asian Field crops | D. A. Sleper<br>J.M. Poehlman | Blackwell Publishers |
| 3. | Principle and Procedures of Plant Breeding Biotechnological and Conventional Approach | G. S. Chahal<br>S. S. Gosla | Narosa Publishers House. New Delhi. |
| 4. | Plant Breeding Principle and Methods. | B. D. Singh | KalyaniPublication New Delhi. |

| | | | | | |
|---|---|---|---|---|---|
| ***Course :*** | *ENTO 365* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
| ***Course title:*** | *Management of Beneficial Insects* | | | | |

# Syllabus

**Theory**

Importance of beneficial insects.

Bee keeping, pollinating plants and their cycle, bee biology, commercial methods of rearing. Equipment used. Seasonal management. Bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee.

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. Pests and diseases of silkworm, their management, rearing appliances of mulberry silkworm and methods of disinfection.

Species of Lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.

Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques, important species of pollinators, weed killer 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.

# Teaching schedule

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Importance of beneficial insects in Agriculture,<br>Honeybee, Silkworm, Lac insects, Bioagents as natural enemies, | 20 |

| Lecture | Topic | Weightage (%) |
|---|---|---|
| | Various Institutes related to beneficial insects | |
| 2 | **Apiculture**: Introduction and history of Beekeeping<br>Bee keeping, morphology and anatomy, bee biology,<br>Pollinating plants and their cycle, bee conservation | |
| 3 | Commercial methods of bee rearing, equipments used,<br>seasonal management of bees | |
| 4 | Bee hives and their description, Bee pasturage, bee foraging,<br>behaviour and communication | |
| 5 | Enemies- Insect pests and diseases of honey bee and their management | |
| 6 | **Sericulture**: Related terminologies, History and development of silkworms in India, types of silkworm, voltinism and biology of silkworm | 30 |
| 7 | Mulberry cultivation, crop varieties, method of harvesting and preservation of mulberry leaves | |
| 8 | Rearing house and rearing appliances of mulberry silkworm, methods of disinfection and hygiene | |
| 9 | Silkworm rearing, mounting, harvesting and marketing of cocoons | |
| 10 | Pest and diseases of silkworm and their management | |
| 11 | **Lac culture**: Species of lac insect, morphology, biology, behaviour, host plants | 10 |
| 12 | Lac production and its uses, Types of lac- seed lac, button lac, shellac, and lac-products | |
| 13 | **Biocontrol agents** (Natural Enemies): Introduction of bioagents, Ideal characteristics of bioagents, Successful examples of biological control | 35 |
| 14 | General classification: Important insect orders bearing predators and parasitoids used in pest control<br>Identification of major parasitoids and predators commonly used in biological control of crop pests. | |
| 15 | Major parasitoids: *Trichogramma sp., Chelonusblackburni, Cotesia (Apanteles) sp., Bracon sp., Epiricaniamelanoleuca, Goniozusnephantidis, Campoletischloridae,*<br>Major predators: *Chrysoperla* sp., Australian lady bird beetle- *Cryptolaemus*montrouzieri<br>Weed killers: *Zygogrammabicolorata*, *Neochetina*spp. | 20 |
| 16 | Mass multiplication and field release techniques of some important parasitoids: *T. chilonis, Chelonusblackburni, Cotesia /* | |

| Lecture | Topic | Weightage (%) |
|---|---|---|
| | *Bracon, Goniozusnephantidis, Epiricaniamelanoleuca* | |
| 17 | Mass multiplication and field release techniques of important predators: *Chrysoperla* sp., Australian lady bird beetle,<br>Weed predators/killers: *Zygogramma bicolorata*, *Neochetina* sp. | |
| 18 | Important species of pollinator and scavengers with their importance | 5 |

***b) Practical***

| Experiment | Topic |
|---|---|
| 1 | Studies on honey bee colony: Bee species and castes of bees |
| 2 & 3 | Bee keeping appliances and seasonal management |
| 4 | Bee enemies and diseases |
| 5 & 6 | Bee pasturage, bee foraging and communication |
| 7 & 8 | Types of silkworm, voltinism and biology of mulberry silkworm |
| 9 | Mulberry cultivation, mulberry varieties and methods of harvesting of leaves |
| 10 | Rearing of mulberry silkworm on artificial diet / natural mulberry leaves |
| 11 | Studies on strains / species of lac insect, host plant and their identification |
| 12 | Identification of other important pollinators and scavengers. |
| 13<br>14 | Mass production of host insect- *Corcyra cephalonica*St.<br>Mass multiplication of parasitoids: *Trichogrammachilonis*, *Chelonusblackburnii*, *Goniozusnephantidis* |
| 15 | Mass multiplication of predators: *Chrysoperla* sp. and<br>Australian lady beetle- *Cryptolaemusmontrouzieri*Mulsant |
| 16, 17 and 18 | Visit to research and training Institution/Unit of Beekeeping, Sericulture, Lac culture and Bioagent production units. |

| Topic | Marks |
|---|---|
| Collection | 06 |
| Writing of procedures | 30 |
| Viva | 04 |
| Laboratory work / General performance | 10 |
| **Total** | **50** |

## Suggested Readings:


1) *Singh, S., 1975.Bee keeping in India – ICAR, New Delhi., 214p.*
2) *Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar, 2003, Beekeeping, UAS Dharwad*
3) *Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.*
4) *Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Agrobios (India).*
5) *Paul DeBach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 edition (27 June 1991)*
6) *Y.A. Shinde and BR Patel. Sericulture in India*
7) *Tribhuwan Singh. Principles and Techniques of Silkworm Seed Production, Discovery publishing House Pvt. Ltd*
8) *M.L. Narasaiah. Problems and Prospects of Sericulture.discovery publishing House Pvt. Ltd.*
9) *Ganga, G. and SulochanaChetty, J. 1997. An Introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.*
10) *Krishnaswamy, S. (Ed). 1978. Sericulture Manual - Silkworm Rearing. FAO Agril. Services bulletin, Rome.*
11) *Glover, P.M. 1937. Lac Cultivation in India. Indian Lac Research Institute, Ranchi.*
12) *Jolly, M.S. 1987. Appropriate Sericulture Techniques. International Centre for Training and Research inTropical Sericulture, Mysore, 209.*
13) *K.P. Srivastava. A Text Book on Applied Entomology. Vol. I & II, Kalyani Publishers, Ludhiana*
14) *B.R. David and V.V. Ramamurthy. Elements of Economic Entomology, 7$^{th}$Edn. Namrutha Publications, Chennai*


| ***Course :*** | *HORT 366* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Post-harvest Management and Value Addition of Fruits and Vegetables* | | | | |

## Syllabus

**Theory**

Importance of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Role of ethylene; Post harvest disease and disorders; Heat, chilling and freezing injury; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; 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.

## Teaching Schedule:

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Importance of fruits and vegetables, extent and possible causes of post harvest losses | 10 |
| 2 | Pre-harvest factors affecting postharvest qualityandMaturity | |
| 3 | Ripening and changes occurring during ripening | 10 |
| 4 | Respiration and factors affecting respiration rate, Role of ethylene | |
| 5 | Post harvest diseases& disorders | |
| 6 | Heat, chilling & freezing injury | |
| 7 | Harvesting and field handling | 10 |
| 8 | Storage (ZECC, Cold storage, CA, MA, and Hypobaric) | 10 |
| 9 | Value addition concept | 05 |
| 10 | Principles and methods of preservation | 10 |
| 11 | Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards | 10 |
| 12 | Fermented and non-fermented beverages | 05 |
| 13 | Tomato products- Concepts and Standards | 10 |
| 14 | Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying | 05 |
| 15 | Canning -– Concepts and Standards | 10 |
| 16 | Packaging of products | 05 |

***b) Practical Schedule***

| Experiment | Topic |
|---|---|
| 1 | Applications of different types of packaging containers for shelf life extension. |
| 2 | Effect of temperature on shelf life and quality of produce. |
| 3 | Demonstration of chilling and freezing injury in vegetables and fruits. |
| 4 | Extraction and preservation of pulps and juices. |
| 5 | Preparation of Jam |
| 6 | Preparation of Jelly |
| 7 | Preparation of RTS and nectar |
| 8 | Preparation of squash and syrup |
| 9 | Preparation of osmotically dried products |
| 10 | Preparation of fruit bar and candy |

| | |
|---|---|
| 11 | Preparation of tomato products |
| 12 | Preparation of canned products. |
| 13 | Layout and planning of pack house |
| 14 | Layout and planning of processing unit |
| 15 | Quality evaluation of products -- physico-chemical and sensory. |
| 16 | Visit to processing unit/ industry. |

## Suggested Readings:

| Book | Title of Book | Authors |
|---|---|---|
| 1 | Fruits and vegetables Preservation | Girdharilal, Sidappa and Tondan |
| 2 | Post Harvest Physiology, Handling, Utilization of tropical and subtropical fruits and vegetables | E.R.B. Pantastico |
| 3 | Preservation of fruits and vegetables – Principals and Practices | Shrivastava and Sangeev Kumar |
| 4 | Commercial fruits and Vegetable Products | W.V.Cruess |
| 5 | Post Harvest handling of fruits and Vegetables | Bal and Sandhu |

| | | | | | |
|---|---|---|---|---|---|
| ***Course :*** | *ELE HORT 367* | | ***Credit:*** | *3(2+1)* | ***Semester-VI*** |
| ***Course title:*** | *Landscaping* | | | | |

## Syllabus

**Theory**

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

## Teaching Schedule

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Importance and scope of landscaping | 5 |
| 2 - 4 | Principles of landscaping | 5 |
| 4 - 6 | Garden styles and types, terrace gardening, vertical gardening, | 10 |
| 7 - 9 | Garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. | 10 |
| 10–12 | Gardens for special purposes. | 05 |
| 13–16 | Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. | 10 |
| 17–19 | Climber and creepers: importance, selection, propagation, planting, | 05 |
| 20–21 | Annuals: selection, propagation, planting scheme, | 05 |
| 22–23 | Other garden plants: palms, ferns, grasses and cacti succulents. | 05 |
| 24–25 | Pot plants: selection, arrangement, management. | 05 |
| 26 | Bio-aesthetic planning: definition, need, planning; | 05 |
| 27–29 | 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. | 15 |
| 30 | Bonsai: principles and management, | 05 |
| 31 | Lawn: establishment and maintenance. | 05 |
| 32 | CAD application. | 05 |
| | **Total** | **100** |

**b) Practical**

| Experiment | Topic |
|---|---|
| 1. | Identifications and propagation of annual, herbs and shrubs |
| 2. | Identifications and propagation of climbers, creepers and perennials |
| 3. | Identifications and propagation palms, ferns, grasses, cacti and succulents |
| 4. | Planning, designing and layout of formals and informal gardens |
| 5. | Planning, designing and layout special gardens. |
| 6. | Study of different potting mixtures, soilless cultures and preparation of potted plants |
| 7. | Maintenance and repairs of potted plants |
| 8. | Planting and Maintenance of Lawn |

| | |
|---|---|
| 9. | Irrigation and nutrient management in Landscape garden |
| 10. | Practicing terrarium gardens and vertical garden |
| 11. | Development and Maintenance of topiary |
| 12. | Practicing flower Arrangement |
| 13. | Bonsai Practicing and training |
| 14. | Canopy Management in ornamentals shrubs and perennials |
| 15 & 16 | Visit to Landscape gardens. |

## Suggested Readings:


1) *Complete Gardening in India – Gopalswamiengar*
2) *Complete Home Gardening – Dey, S.C.*
3) *Floriculture and Landscaping – Bose, T.K.*
4) *Floriculture and Landscaping – Deshraj*
5) *Floriculture in India – Randhawa and Mukhopadhyay*
6) *Introduction to Landscaping, Designing, Construction and Maintenance – Ronald J.Biondo and Charles B. Schroder*
7) *Landscape Gardening & Design with Plants – Supriya Kumar Bhattacharjee*
8) *Landscaping principles and practices – Jack E. Ingels*


| | | | | | |
|---|---|---|---|---|---|
| ***Course :*** | *ELE HORT 368* | | ***Credit:*** | *3(2+1)* | ***Semester-VI*** |
| ***Course title:*** | Hi-tech Horticulture | | | | |

## Syllabus

**Theory**

*Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding, Components of precision farming: 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

## Teaching Schedule

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Introduction, importance and scope of Hi- tech horticulture in India | 10 |
| 2 | Hi- tech nursery management and mechanization of horticultural crop | 10 |
| 3 | Micro- propagation of horticultural crops | |
| 4 | Hi- tech field preparation and planting methods | 5 |
| 5 | Protected cultivation: advantages and constraints | 5 |
| 6-7 | Environmental control in green house -– temperature, light, $CO_2$, relative humidity and ventilation methods and techniques. | 10 |
| 8 | Micro irrigation systems and its components | 5 |
| 9 | EC and pH based irrigation / fertigation scheduling | 5 |
| 10-11 | Hi-tech canopy management of horticultural crop | 5 |
| 12-16 | High density orcharding in mango, guava, papaya, citrus, pineapple etc. | 10 |
| 17 | Remote sensing and Geographical Information System (GIS) | 5 |
| 18 | Differential Geo-positioning System (DGPS) | |
| 19-30 | Components of precision farming and application of precision farming in horticultural crops (fruits, vegetables and ornamental crops 2 crops each) | 20 |
| 31 | Mechanized harvesting of produce | 5 |
| 32 | Post harvest management for export | 5 |
| | **Total** | **100** |

***b) Practical***

| Experiment | Topic |
|---|---|
| 1 | Tools and equipments, identification and application |
| 2 | Study of different types of polyhouses and shade net houses |
| 3-4 | Intercultural operations in high density orchards |
| 5-6 | Intercultural operations in vegetables and flowers |
| 7-8 | Plant architecture |
| 9-10 | Micropropogation of horticultureal crops |
| 11-12 | Hi-tech nursery production technique in protrays |
| 13 | Hi-tech Irrigation systems |
| 14 | Soil and water EC, pH measurement and fertigation |
| 15 | Precision farming techniques used in horticultural crops |
| 16 | Visit to hi-tech orchard/nursery |

## Suggested Readings:


1. T. A. More, Karale A. R. and Patil M.T. 2001. Hi-tech Horticulture, CAFT (Fruits), MPKV, Rahuri.
2. Balraj Singh.2005. Protected cultivation of vegetable crops, Kalyani Publishers, New Delhi.
3. Patil, M.T and Patil, P.V. 2004. Commercial Protected Floriculture, MPKV, Rahuri
4. Commercial Floriculture – Prasad & Kumar.
5. Proceedings of International seminar on protected cultivation in India, held at Bangalore (1997)
6. Greenhouse operation and management- Paul. V. Nelson


| ***Course :*** | *ECON 365* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Farm Management, Production and Resource Economics* | | | | |

## *Syllabus*

**Theory**

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.

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 labor 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. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies**,** Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation.

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

***Practical***

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

## *Teaching Schedule*

***a) Theory***

| Lecture | Topic | Weightages |
|---|---|---|
| 1 | Farm Management – Meaning – Definitions – Scope – Objectives - Relationship with other sciences | 2 |
| 2 | Farm – Meaning – Definition – its types and characteristics – factors determining size of farms | 2 |
| 3 | Economic principles applied to farm management – Principle of variable proportions – Determination of optimum input and optimum output | 4 |
| 4 | Minimum loss principle (Cost Principle) - Principle of factor substitution | 3 |
| 5 | Principle of product substitution - Law of Equi-marginal returns – Opportunity cost principle | 3 |
| 6 | Principle of comparative advantage – Time comparison principle | 4 |
| 7 | Types of farming – Specialization, Diversification, Mixed farming, Dry farming and Ranching – factors influencing types of farming | 4 |
| 8 | Types of farm business organizations – Peasant farming, Co-operative farming, Capitalistic farming, Collective farming and State farming | 3 |
| 9 | Meaning and concept of cost –types of costs – cost concepts – farm income measures – Gross income, farm business income, family labour income, net farm income & farm investment income | 4 |
| 10 | Farm business analysis – meaning and concept of farm income and profitability – technical and economic efficiency measures | 4 |
| 11 | Farm records and accounts – importance – types of farm records needed to maintain on farm | 3 |
| 12 | Farm inventory – methods of valuation– net selling price, cost less depreciation, market price, cost method, replacement cost less depreciation and income capitalization methods | 5 |
| 13 | Balance sheet or Networth statement – Assets, liabilities and networth – ratio measures | 3 |

| Lecture | Topic | Weightages |
|---|---|---|
| 14 | Income statement or profit and loss statement – Receipts, expenses and net income – ratio measures | 4 |
| 15 | Income statement or profit and loss statement – Receipts, expenses and net income – ratio measures | 3 |
| 16 | Farm planning – Meaning – Need for farm planning – types of farm plans – simple farm plan and whole farm plan – Characteristics of a good farm plan – basic steps in farm planning | 4 |
| 17 | Farm budgeting – Meaning – types of farm budgets – Enterprise budgeting – Partial budgeting and whole farm budgeting. | 3 |
| 18 | Linear programming – Meaning – Assumptions – Advantages and limitations | 4 |
| 19 | Risk and uncertainty in agriculture – nature and sources of risks – Production and technical risks – Price or marketing risk – Financial risk – methods of reducing risk | 3 |
| 20 | Agricultural Production Economics – Definition – Nature – Scope and subject matter of Agricultural Production Economics – Objectives of Production Economics – Basic Production Problems | 4 |
| 21 | Law of returns - Law of increasing returns – Law of constant returns – Law of decreasing returns | 3 |
| 22 | Factor-product relationship – production function and its types – Elasticity of production - Three stages of production function | 3 |
| 23 | Factor-factor relationship – Isoquant and their characteristics – MRTS – Types of factor substitution | 2 |
| 24 | Iso-cost lines – Characteristics – Methods of determining Least-cost Combination of resources – Expansion path – Isoclines – Ridge lines | 4 |
| 25 | Product-product relationship – Production possibility curve – Marginal rate of product substitution – Types of enterprise relationships – Joint products – Complementary – Supplementary – Competitive and Antagonistic products | 3 |
| 26 | Iso-revenue line and characteristics – Methods of determining optimum combination of products – Expansion path – Ridge lines | 2 |
| 27 | Resource productivity – Returns to scale | 2 |
| 28 | Resource economics – Definition, subject matter and scope - Differences between NRE and agricultural economics | 3 |
| 29 | Natural resources classification and characteristics – Resource depletion and causes for the same | 2 |
| 30 | Positive and negative externalities in agriculture | 2 |
| 31 | Inefficiency and welfare loss, solutions | 2 |
| 32 | Important issues in economics and management of common property resources of land, water, pasture and forest resources, | 3 |

| Lecture | Topic | Weightages |
|---|---|---|
| | etc. | |
| | **Total** | **100** |

***b) Practical***

| Exercise | Topic |
|---|---|
| 1 | Basic concepts and terms |
| 2 | Determination of optimum input and output, and least cost combination of inputs |
| 3 | Determination of profitable combination of products and application of principle of equi-marginal returns |
| 4 | Seven types of costs and their computation |
| 5 | Farm cost concepts and their imputation procedure |
| 6 | Depreciation methods |
| 7 | Farm holding survey |
| 8 | Livestock – Farm survey |
| 9 | Estimation of cost of cultivation and farm income measures of major crops |
| 10 | Farm inventory analysis |
| 11 | Farm financial analysis – Preparation and analysis of balance sheet |
| 12 | Preparation and analysis of profit and loss statement |
| 13 | Preparation of farm plans |
| 14 | Preparation of enterprise budget and partial budge |
| 15 | Study of farm management aspects related to Agriculture college farm |
| 16 | Final Practical Examination |

## *Suggested Readings:*


1) Economics of Agricultural Production and Resource Use: Heady, Earl O, Prentice Hall of India, Private Limited, New Delhi, 1964
2) Introduction to Agricultural Economic Analysis: BISHOP, C.E., & TOUSSAINT, W.D., NEWYORK, John Wiley and Sons, Inc., London, 1958
3) Fundamentals of Farm Business Management: S.S. Johl, J.R. Kapur, Kalyani Publishers, New Delhi
4) Agricultural Economics: Subba Reddy S., Raghuram P., NeelakantaSastry T.V., Bhavani Devi I., Oxford and IBH Publishing Company, Private Limited, New Delhi, 2006
5) Farm Management Economics: Heady Earl O and Herald R. Jenson, Prentice Hall, New Delhi, 1954
6) Elements of Farm Management Economics: I.J. Singh, Affiliated East-West press, Private Limited, New Delhi

7) Introduction to Farm Management: Sankhayan, P.L., Tata – Mc Graw – Hill Publishing Company Limited, New Delhi, 1983

8) Resource Economics: A. Randall Wiley, Oxford India Publication

9) Environmental Economics: R. N. Bhattacharya, Oxford India Publication

10) Hand Book of Environmental Economics: K. Chopra and Vikram Dayal, Oxfor India Publication

11) Resource Economics: Conrad, Jon M, Cambridge University Press

12) Environmental economics: Prakash Vohra, Commonwealth Publishers

13) Natural Resource Economics: Theory and Applications in India: Kerr, John M, Marothia D.K., Katar Singh, Ramasamy C & Bentley W.R., Oxford & IBH Publishing Company, Private Limited, New Delhi, 1997

14) Environmental Economics: Sankar U, Oxford University Press, 2001

15) Environmental and Natural Resource Economics: Tietenberg T. 6th Ed. Addison Wesley 2003

| ***Course :*** | *ENGG 364* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Protected Cultivation and secondary Agriculture* | | | | |

## Syllabus

**Theory**

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.Materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, , re-circulatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

**Practical**

Study of different type of greenhouses based on shape.Study of Greenhouse Covering and Construction Materials. Study of Cooling System used in Green House. Study of Irrigation System used in Green House. Cost Estimation of Poly houses for 560 Sq.m Study of greenhouse equipment's. Visit to Commercial Green House. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods.Study of Grain Dryers.Study of Material Handling Equipments.Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).Determination of Moisture content of various grains by Universal moisture meter.Field visit to seed processing plant.

## Teaching Schedule

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| **1.** | Green house technology - Green house technology: Introduction, History of green house, Advantages of green house, Green house effect. | 6 |
| **2.** | Types of Green houses-Types of Green houses: Green house type based on Shape, Utility, Construction and Covering materials | 7 |
| **3.** | Plant response to green house environment -Plant response to green house environment : Light, Temperature, Relative Humidity, Ventilation and Carbon di-oxide. | 6 |
| **4.** | Planning and Design of green house- Planning and Design of green house: Site selection and orientation, structural design and covering materials. | 6 |
| **5.** | Materials of construction - Materials of construction for traditional and low cost green house: Wood, G.I., aluminum, steel, R.C.C. and Glass | 6 |
| **Lecture** | **Topic** | **Weightage (%)** |
| **6.** | Irrigation Systems used in green house - Irrigation Systems used in green house: Rules of watering, Overhead Sprinklers , Drip irrigation system and Foggers (Mist spraying) | 6 |
| **7.** | Design criteria of green house for Cooling and Heating purposes - Design criteria of green house for Cooling and Heating purposes: Cooling - Natural ventilation, forced ventilation Heating- Heating system, solar heating system, Water & Rock storage. | 6 |
| **8.** | Engineering Properties - Engineering Properties of cereals, pulses and oil seed. Their applications in PHT equipment design and operation: Physical properties: Size and Shape (Roundness and Sphericity) Porosity, Coefficient of friction, and angle of repose, Thermal properties: Definition of Specific heat and Thermal conductivity. Aero & hydrodynamic properties: Definition of Terminal velocity | 6 |
| **9.** | Drying and Dehydration - Drying and Dehydration: Definition of drying and dehydration, Utilities/Importance of drying Grain drying Theory- EMC definition, Thin layer drying and deep bed drying | 6 |
| **10 & 11** | Moisture Measurements- Moisture measurements: Moisture content and its measurement, Moisture content representation: Dry basis and wet basisMoisture Content determination Methods:- Direct methods- Air oven method, Vacuum oven method and Infra-red methodIndirect Methods- Electrical resistance method and Di-electric method . | 12 |
| **12.** | Various Drying Methods - Various Drying Methods: Sun drying, Mechanical Drying Mechanical Drying Methods:- Contact drying, Convection drying, Radiation drying | 6 |

| Lecture | Topic | Weightage (%) |
|---|---|---|
| **13.** | Numerical on Moisture content and its representation- Numerical on Moisture content and its representation: Conversion of wet basis moisture contents to dry basis moisture contents<br>Conversion of dry basis moisture contents to wet basis moisture contents, Problems on drying<br>Problems on moisture contents Problem No.1 & No.2. | 6 |
| **14 & 15** | Commercial Grain Dryers - Commercial Grain Dryers: Construction and working principle - Deep bed dryer, Flat bed dryer, Recirculating dryer –<br>(LSU and Baffle dryers) , Tray dryer and Solar dryers | 13 |
| **16.** | Material Handling Equipments- Material Handling Equipment's: Construction and working principle-<br>Conveyor- Belt conveyor and Screw conveyor<br>Elevator- Bucket elevator | 8 |
| | **Total** | **100** |

***b) Practical***

| Experiment | Topic |
|---|---|
| 1 | Study of Different Types of Green Houses |
| 2 | Study of Green House Covering and Constructional Materials |
| 3 | Study of Cooling System Used in Green House |
| 4 | Study of Instruments and Equipments used in Green House |
| 5 | Study of Irrigation Systems Used in Green House |
| 6 | Cost Estimation of Poly-house for 560 sqm. |
| 7 | Visit to Commercial Green House |
| 8 | Determination of Moisture Content of Various Grains by Oven Method |
| 9 | Determination of Moisture Content of Various Grains by Universal Moisture Meter |
| 10 | Determination of Moisture Content of Various Grains by Infrared Moisture Meter |
| 11 | Determination of Physical Properties of Grains |
| 12 | Study of LSU and Baffle Dryers |
| 13 | Study of Tray and Solar Dryers |
| 14 | Study of Material Handling Equipments-Belt Conveyor, Screw Conveyor and Bucket Elevator |
| 15 | Visit to Seed Processing Plant |
| 16 | Visit to Post Harvest Laboratories |

## Suggested Readings


1) *Green House Technology & Management by K.RadhaManohar (2000) C.Igathinathane B.S. Publications 4-4-309, Sultan Bazar, Hyderabad-500095.*

2) *Unit Operations of Agricultural Processing by K.M. Sahay and K.K.Singh (2009)Vikas Publishing House Pvt. Ltd. New Delhi-110007*

3) *Post harvest Technology of Cereals, Pulses and Oilseeds by A. Chakraverty (1997)Oxford & IBH Publishing Co. Pvt. Ltd., 66 Janpath, New Delhi-110001.*

4) *Green House management by L R Taft (1997) Biotech Books, Delhi*

5) *Post Harvest Technology and Quality management of Fruits and Vegetables by P. Suresh Kumar, V R Sagar and M Kanwat (2009) Agrotech Publishing Academy, Udaipur*

6) *A Text Book of Greenhouse and Post Harvest Technology by B.P. Sawant, J.M. Potekar, H.W. Awari(2008) Nikita Publication, Latur.*

7) *Green House Technology by G. N. Tiwari and R.K. Goyal(1998) Narosa publishing House, 6 community Centre, Panchsheel Park New Delhi- 110017*

8) *Green House Technology and Application by V M Salokhe and A KSharma(2006) Agrotech Publishing Academy, Udaipur*

9) *Emerging Trends in PHT and Utilization of Plant Food by N Khetarpaul et al(2003) Agrotech Publishing Academy, Udaipur*

10) *Green House Operation and Management by Nelson and Paul V (1994) Prentice Hall, USA*

| ***Course :*** | *PATH 365* | | ***Credit:*** | *3(2+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Diseases of Field and Horticultural Crops and their Management – II* | | | | |

## Syllabus

**Theory**

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

**Field Crops**:Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle;Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;Sunflower: Sclerotinia stem rot and Alternaria blight; Rust, Downy mildewMustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot;Gram: wilt, grey mould and Ascochyta blight;Lentil: rust and wilt;Cotton: anthracnose, vascular wilt, and black arm;Pea: downy mildew, powdery mildew and rust

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

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

**Practical**

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

## Teaching Schedule

### *a) Theory*

| Lecture | Topic | Weightage (%) |
|---|---|---|
| | Symptoms, etiology, disease cycle and management of major diseases of following crops | |
| | **Field crops** | |
| 1,2,3 | Wheat: Rusts, loose smut, Karnal bunt, powdery mildew, Alternaria blight, and ear cockle | 5 |
| 4,5 | Sugarcane: Red rot, Smut, Wilt, Grassy shoot, Ratoon stunting and Pokka Boeng | 5 |
| | **Oilseed** | |
| 6,7 | Sunflower: Sclerotinia stem rot and Alternaria blight, Rust, Downy mildew | 3 |
| 8,9 | Mustard: Alternaria blight, White rust, Downy mildew and Sclerotinia stem rot | 3 |
| | **Pulses** | |
| 10 | Gram: wilt, grey mould and Ascochyta blight | 5 |
| | Lentil: rust and wilt | 4 |
| 11 | Linseed :Alternaria bud blight, Rust ,Powdery mildew | 2 |
| 12 | Pea: Downy mildew, Powdery mildew and Rust, wilt | 5 |
| | **Cash Crop** | |
| 13,14 | Cotton: Root rot, Wilt, Anthracnose, and black arm, Dahiya diseases, leaf curl of cotton, 2-4-D injury | 7 |
| | **Horticultural Crops** | |
| 15,16,17, | Mango: Die back, Anthracnose, Mango-malformation, bacterial blight and powdery mildew, Spongy tissue, Red rust, Pink diseases, Loranthus, Stone graft Mortality, Lime induced chlorosis | 6 |
| 18,19 | Citrus : Citrus canker, Gummosis, Fruit rot, Citrus greening, Anthracnose, Tristeza, Citrus Exocortis, Scab of citrus, Mottle leaf of citrus | 6 |
| 20,21 | Grape vine: Downy mildew, Powdery mildew, Anthracnose, Bacterial Canker, Grape fan-leaf virus | 6 |
| 22 | Apple: Scab, Powdery mildew, Fire blight and Crown gall, Mosaic | 3 |
| 23 | Peach: leaf curl | 2 |
| 23 | Strawberry: Leaf spot | 3 |
| | **Vegetables** | |
| 24 | Potato: Early and late blight, black scurf, leaf roll, and Mosaic | 5 |
| 25,26 | Cucurbits: Downy mildew, powdery mildew, wilt, Angular leaf spot, Mosaic, TOSPO virus | 5 |
| 27 | Onion: Purple blotch, and Stemphylium blight, Downy mildew, Smut, Smudge, Erwinia rot | 6 |
| 28 | Garlic : Neck and bulb rot, and Stemphylium blight, Blemish, Black mould | 3 |
| 29 | Chilli : Anthracnose and fruit rot, Wilt and leaf curl | 5 |
| 30 | Coriander : Stem gall, Powdery mildew, Wilt | 2 |
| 30 | Turmeric: leaf spot | 3 |
| | **Ornamental Crops** | |
| 31 | Marigold :Botrytis blight, Alternaria blight | 3 |
| 32 | Rose: Dieback, Powdery mildew and Black leaf spot | 3 |

| Lecture | Topic | Weightage (%) |
|---|---|---|
| | **Total** | **100** |

**Practical**

| Experiment | Topic |
|---|---|
| | Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Collection and preservation of disease specimen (Note: Students should submit 50 pressed and well-mounted specimens) |
| | **Field crops** |
| 1 | Wheat: Rusts, loose smut, Karnal bunt, powdery mildew, Alternaria blight, and ear cockle |
| 2 | Sugarcane: Red rot, Smut, Wilt, Grassy shoot, Ratoon stunting and Pokka Boeng |
| | **Oilseed** |
| 3 | Sunflower: Sclerotinia stem rot and Alternaria blight, Rust, Downy mildew |
| 4 | Mustard: Alternaria blight, White rust, Downy mildew and Sclerotinia stem rot |
| | **Pulses** |
| 5 | Gram: wilt, grey mould and Ascochyta blight |
| 6 | Lentil: rust and wilt |
| 7 | Linseed :Alternaria bud blight, Rust ,Powdery mildew |
| 8 | Pea: Downy mildew, Powdery mildew and Rust, wilt |
| | **Cash Crop** |
| 9 | Cotton: Root rot, Wilt, Anthracnose, and black arm, Dahiya diseases, leaf curl of cotton, 2-4-D injury |
| | **Horticultural Crops** |
| 10 | Mango: Die back, Anthracnose, Mango-malformation, bacterial blight and powdery mildew, Spongy tissue, Red rust, Pink diseases, Loranthus, Stone graft Mortality, Lime induced chlorosis |
| 11 | Citrus : Citrus canker, Gummosis, Fruit rot, Citrus greening, Anthracnose, Tristeza, Citrus Exocortis, Scab of citrus, Mottle leaf of citrus |
| 12 | Grape vine: Downy mildew, Powdery mildew, Anthracnose, Bacterial Canker, Grape fan-leaf virus |
| 13 | Peach: leaf curl |
| 14 | Apple: Scab, Powdery mildew, Fire blight and Crown gall, Mosaic |
| 15 | Strawberry: Leaf spot |
| | **Vegetables** |
| 16 | Potato: Early and late blight, black scurf, leaf roll, and Mosaic |
| 17 | Cucurbits: Downy mildew, powdery mildew, wilt, Angular leaf spot, Mosaic, TOSPO virus |
| 18 | Onion: Purple blotch, and Stemphylium blight, Downy mildew, Smut, Smudge, Erwinia rot |
| 19 | Garlic : Neck and bulb rot, and Stemphylium blight, Blemish, Black mould |
| 20 | Chilli : Anthracnose and fruit rot, Wilt and leaf curl |
| 21 | Coriander : Stem gall, Powdery mildew, Wilt |
| 22 | Turmeric: leaf spot |
| | **Ornamental Crops** |
| 23 | Marigold :Botrytis blight, Alternaria blight |
| 24 | Rose: Dieback, Powdery mildew and Black leaf spot |

| Experiment | Topic |
|---|---|
| 25 | Field visit for the diagnosis of field problems |

Suggested Readings


1) *Agrios, GN. 2010. Plant Pathology. Acad. Press*
2) *Diseases of Horticultural Crops fruits (1999) By Verma L.R and Sharma R.c,Indus Publishing company, New Delhi*
3) *Diseases of fruit crops (1986) By V.N.Pathak ,Oxford & IBH publication, New Delhi*
4) *Diseases of fruit crops (1986) By R.S.Singh ,Oxford & IBH publication, New Delhi*
5) *Diseases of Fruits and vegetables (2007) S.A.M.H. Naqvi,Springer Science & Business Media*
6) *Diseases of Plantation Crops (2014) By P.Chowdappa, Pratibha Sharma IPS 263pp*
7) *Diseases of Horticulture Crops and their management ,ICAR e-book for B.Sc.(Agri) & B.Tech (Agri) By TNAU pp172*
8) *Advances in the diseases of Plantation crops & spices (2004) P.Santha Kumari,International Book Distributing Company , 247 pp*
9) *Mehrotra RS & Aggarwal A. 2007. Plant Pathology. 7th Ed. Tata Mc Graw Hill Publ. Co. Ltd*
10) *Vegetable Diseases : A Colour full Hand book (2006) by Steven T.Koike ,Peter Gladers and Albert Paulus ,Academic Press, pp448*
11) *Diseases of Vegetables crops by R.S.Singh (1987) Oxford & IBH publication, New Delhi*
12) *Plant Diseases.(2008) Singh RS. 20088th Ed. Oxford & IBH. Pub. Co.*
13) *Diseases of Crops Plants in India (2009) By PHI learning Pvt. Ltd, pp 548*
14) *Diseases of Vegetable crops (2005) by Alferd Steferud ,Biotech Books ,New Delhi*
15) *Mehrotra RS & Aggarwal A. 2007. Plant Pathology. 7th Ed. Tata Mc Graw Hill Publ. Co. Ltd*
16) *Diseases of Vegetable Crops ,Diagonosis and Management (2014) Dinesh Singh and P.Chodappa, Today and Tomorrow Printers ,pp734*
17) *Singh H. 1984. House-hold and Kitchen Garden Pests - Principles and Practices. Kalyani Publishers.*


| ***Course :*** | *ELE SSAC 364* | | ***Credit:*** | *3(2+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Agrochemicals* | | | | |

## Syllabus

### Theory

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 ofagrochemicals for sustainable agriculture.Herbicides-Major classes, properties and important herbicides.Fate of herbicides.Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use ofsulfur and copper, Mode of action-Bordeaux mixture and copper

oxychloride.Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and useof Zineb and maneb.Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim,characteristics and use. Introduction and classification of insecticides: inorganic andorganic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroidsNeonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn andrestricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides,Botanicals, plant and animal systemic insecticides their characteristics and uses.Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing ofammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers.Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparationof bone meal and basic slag.Potassic fertilizers: Natural sources of potash, manufacturing ofpotassiumchloride, potassium sulphate and potassium nitrate.Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondaryand micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates,nitrophosphates 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 variouspesticides appliances.Quick tests for identification of common fertilizers.Identification of anionand cation in fertilizer.Calculation of doses of insecticides to be used.To study and identify variousformulations of insecticide available kin market.Estimation of nitrogen in Urea. Estimation of 120water soluble $P_2O_5$ and citrate soluble $P_2O_5$ in single super phosphate. Estimation of potassium inMuraite of Potash/ Sulphate of Potash by flame photometer.Determination of copper content incopper oxychloride.Determination of sulphur content in sulphur fungicide.Determinationof thiram.Determination of ziram content.

## Teaching schedule

***a) Theory***

| Lesson | Topic | *Weightage (%)* |
|---|---|---|
| 1 | Introduction to agrochemicals, their type and role in agriculture, | 2 |
| 2 | Effect of agrochemicals on environment, soil, human and animal health. Merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. | 4 |
| 3 | Fertilizers and their classification; | 3 |
| 4 & 5 | N fertilizers : classification, manufacturing process and properties, their fate and reaction | 4 |
| 6 & 7 | Phosphatic fertilizers, manufacturing process and properties | 4 |
| 8 | Potassic fertilizers and complex fertilizers, their fate and reaction in soils. | 3 |
| 9 & 10 | Secondary nutrients and fertilizers, their type, composition, reaction in soils and effect on crop growth. | 4 |
| 11 | Micronutrient fertilizers, their type, composition, reaction in soils | 4 |

| Lesson | Topic | *Weightage (%)* |
|---|---|---|
| | and effect on crop growth. | |
| 12 | Liquid fertilizers | 3 |
| 13 | Handling and storage of fertilizers | 3 |
| 14 | Biofertilizers and their role in crop production | 4 |
| 15 | Fertilizer control order and insecticide Act | 2 |
| 16 | Introduction and classification of insecticides:Different types of Classification of insecticides. (Based on toxicity, mode of entry, mode of action, chemical nature) | 4 |
| 17 & 18 | Inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroidsNeonicotinoids, Biorationals. | 5 |
| 19 | Insecticide Act and rules. Insecticides banned, withdrawn and restricted use, | 2 |
| 20 | IGRs and Biopesticides. Reduced risk insecticides | 2 |
| 21 | Botanicals, plant and animal systemic insecticides their characteristics and uses. | 3 |
| 22 | Mode of action of insecticides (Pyrethroids, organophosphates, Carbamates and Chitin synthesis inhibitor) | 4 |
| 23 | Fate of insecticides in soil & plant. | 3 |
| 24 | Insecticide resistance and its management | 3 |
| 25 | Pesticide residue- Definition, steps involved in determination of residue. | 3 |
| 26 & 27 | Copper fungicides, formulation of Bordeaux mixture and Bordeaux paste. Chemical reaction involved merits and demerits of Bordeaux mixture. Mode of action of copper fungicides | 5 |
| 28 | Sulfur fungicides: Organic and inorganic sulfur fungicides their classification and mode of action. Preparation of lime sulfur mixture and chemical reaction involved. | 4 |
| 29 | Benzimidazle fungicides, their chemical nature, mode of action and their use | 3 |
| 30 | Introduction to new generation fungicides. VizMetalaxyl, fosetyl Al, Triazoles and shawbilirin fungicides | 4 |
| 31 | Herbicide- Classification, Formulations, Methods of application. | 3 |
| 32 | Mode of action of herbicide- Translocation and absorption | 3 |
| 33 | Persistence and fate of herbicides, Residual effect of herbicides | 3 |

| Lesson | Topic | *Weightage (%)* |
|---|---|---|
| 34 | Introduction to selectivity of herbicide | 2 |
| 35 | Compatibility of herbicides with other Agrochemicals | 2 |
| 36 | Introduction to adjuvants and their use in herbicides | 2 |
| | **Total** | **100** |

***b) Practical***

| Experiment | Topic |
|---|---|
| 1 | Fertilizer Adulteration test / Identification of Adulteration in fertilizer / Detection of adulteration in fertilizers (Rapid test) |
| 2 | Determination of (Amide nitrogen) from urea. |
| 3 | Determination of ammoniacal nitrogen content and nitrate nitrogen content from nitrogenous fertilizer |
| 4 | Determination of water soluble phosphorus in superphosphate (Pumberton method) |
| 5 | Determination of acid soluble phosphorus from rock phosphate |
| 6 | Determination of total potassium content of muriate of potash (by flame photometer). |

| Experiment | Topic |
|---|---|
| 7 | Determination of sulphur content from fertilizer (Gravimetric Method) |
| 8 | Determination of Zinc content from micronutrient fertilizer (EDTA Method) |
| 9 | Study of plant protection appliances |
| 10 | Calculation of doses of insecticides |
| 11 | Study of formulations of pesticides |
| 12 | Study of pesticide application techniques. |
| 13 | Herbicide label information and computation of herbicide doses. |
| 14 | Equipments used for herbicide application and calibration. Demonstration of methods of herbicide application. |
| 15 | Study of phytotoxicity symptoms of herbicides in different crops. |
| 16 | Handling and storage of fungicides and Agrochemicals |
| 17 | Preparation of Bordeaux mixture and Bordeaux paste and fungicides solutions. |
| 18 | Methods of application of fungicides. |

## Suggested Reading

1) *Manures and fertilizers – Yavalkar, Agarwal and Bokde*
2) *Chemistry of fertilizers and manures – Mariakulandi and Manickam*
3) *Nature and properties of soil – N.C. Brady*
4) *Organic manures – Gour, (ICAR publication)*
5) *Recycling of crop, animal, human and industrial waste in Agriculture – H.L.S. Tondon*
6) *Handbook of manures and fertilizers – ICAR publication*
7) *Text book of soil science – Biswas and Mukharjee*
8) *Fundamentals of soil science – ISSS publication*
9) *Text Book of fertilizers – RanjankumarBasak*
10) *Fertilizer Guide – Tondon HLS (1994)*
11) *Handbook on fertilizer usage – Seetharam S, Priswas, BC, Yadav DS, Matneswaru S. (1996)*
12) *Fertilizer control order (1985) The fertilizer Association of India*
13) *The Pesticde manual A world compendium (1995) – British crop production council, UK*
14) *Outline of organic chemistry: Bahl and Tuli*
15) *Chemistry of insecticide: SreeRamulu US (1991)*
16) *Fungicide in plant disease control: Nene YL and Thapliyal*
17) *Principles of weed science: Rao VS (1992)*

| | | | | | |
|---|---|---|---|---|---|
| ***Course :*** | *AHDS 364* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
| ***Course title:*** | *Technology of milk and milk products.* | | | | |

## Syllabus

### Theory

Present status of dairy industry in India. Definition and composition of milk.Physico-chemical properties of milk.Microbial quality of raw milk and standards for different market milk.Factors affecting yield and composition of milk.Physico-chemical and microbial standards for different types of milk.Nutritional importance of milk and its constituents.Reception and processing (Platform test, Chilling, Standardization, Homogenization, Pasteurization, Storage, Marketing) of milk. Classification and composition of milk products (Heat coagulated, Heat and acid coagulated, Evaporated, Fermented Frozen and Fat riched products). Quality management standard and system (BIS/ISI standards, PFA rules, AGMARK, HACCP, FSSAI).International requirement for export of milk and milk products.Preservation of milk and milk products by physical, chemical, biological and herbal

preservatives. Utilization of dairy by-product: whey and high acid milk. Packaging of milk and milk products with modern techniques.

**Practical**

Sampling of milk and milk products.Study of platform tests.Determination of fat by Gerber's method.Determination SNF, TS and specific gravity of milk.Determination of acidity of milk.Determination of adulteration in milk and milk products.Standardization of milk by Pearson's method.Study of cream separator and separation of cream. Preparation of flavoured and chocolate milk. Preparation of *Khoa, Basundi*and *Rabri.* Preparation of *Paneer,Channa* and*Rassogolla.*Preparation of *Dahi, Chakka* and *Shrikhand.*Preparation of Butter.Preparation of *Ghee.*Preparation of Ice-cream and *Kulfi.*Preparation of *Pedha* and *Gulabjamun.* Study of cleaning and sanitization of dairy equipments.

## Teaching Schedule

***a) Theory***

| Lecture | Topic | Weightage (%) |
|---|---|---|
| 1 | Present status of dairy industry in India | 6 |
| 2 | Definition of milk, composition of milk of different livestock species | 7 |
| 3 | Physico-chemical properties of milk | 6 |
| 4 | Factors affecting yield and composition of milk | 7 |
| 5 | Microbial quality of raw milk and standards for different market milk | 9 |
| 6 | Nutritional importance of milk and its constituents | 4 |
| 7 | Reception , standardization and homogenization of milk | 4 |
| 8 | Pasteurization of milk and its methods | 6 |
| 9 | Chilling, storage and marketing of milk | 5 |
| 10&11 | Classification and composition of Indigenous milk products | 10 |
| 12 | Quality management standard and system (BIS/ISI standards, PFA rules, AGMARK, HACCP, FSSAI ) | 7 |
| 13 | International requirements for export of milk and milk products | 6 |
| 14 | Preservation of milk and milk products by physical, chemical, biological and herbal preservatives | 7 |
| 15 | Utilization of dairy by-products like whey and high acid milk | 8 |
| 16 | Packaging of milk and milk products with modern techniques | 8 |
| | **Total** | **100** |

**b) Practical**

1. Study of platform tests and sampling of milk and milk products
2. Determination of fat by Gerber's method
3. Determination SNF, TS, specific gravity and acidity of milk
4. Determination of adulteration in milk and milk products
5. Standardization of milk by Pearson's method
6. Study of cream separator and separation of cream
7. Preparation of flavoured and chocolate milk
8. Preparation of *Khoa, Basundi*and *Rabri*
9. Preparation of *Paneer,Channa* and*Rassogolla*
10. Preparation of *Dahi, Chakka* and *Shrikhand*
11. Preparation of Butter
12. Preparation of *Ghee*
13. Preparation of Ice-cream and *Kulfi*
14. Preparation of *Pedha* and *Gulabjamun*
15. Study of cleaning and sanitization of dairy equipments
16. Visit to milk processing plant.

## Suggested Reading


1) Milk and Milk Products – Winton and Winton (1993), Agrobios (India), Agro. House, Behind Nasrani Cinema, Chopsani Road, Jodhapur

2) *Milk Testing – Davis J. G. Agrobios (India), Agro. House, Behind Nasrani Cinema, Chopsani Road, Jodhapur.*

3) *Chemistry of Milk and Milk Products – Singh V. B. (1965), Asian Publishers, New mandi, Muzaffarnagar.*

4) *Dairying in India – Gupta, H. A. (1997) Kalyani Publisher, 1/1 Rajinder Nagar, Ludhiana.*

5) *Outlines of Dairy Technology – Sukumar De (2000) Oxford University Press, New Delhi*


| ***Course :*** | *FST 362* | | ***Credit:*** | *2(2+0)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *Principles of Food Science and Nutrition* | | | | |

## Syllabus

**Theory**

Concepts of Food Science (Properties of food: physical, chemical and sensory: their measurements); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions); Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of

fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying, high pressure processing, microwave processing, etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition., Fortification and enrichment of food, National programmes and role of national and international agencies in improving nutritional status of the community.

## Teaching Schedule

***a) Theory***

| Lecture | Topics | Weightage (%) |
|---|---|---|
| 1-5 | Concepts of Food Science (Properties of food: physical, chemical and sensory: their measurements) | 15 |
| 6-10 | Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions) | 15 |
| 11-14 | Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods) | 10 |
| 15-18 | Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying, high pressure processing, microwave processing, etc.) | 10 |
| 19-21 | Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders | 10 |
| 22-23 | Energy metabolism (carbohydrate, fat, proteins) | 5 |
| 24-25 | Balanced/ modified diets, Menu planning | 5 |
| 26-29 | New trends in food science and nutrition | 10 |
| 30-33 | Fortification and enrichment of food | 10 |
| 34-36 | National programmes and role of national and international agencies in improving nutritional status of the community. | 10 |
| | **Total** | **100** |

## Suggested Readings:


1) *Owen R, Fennema. 1996. Food Chemistry, 3rd Ed. Marcel Dekker, Inc., New York, USA.*

2) *M. ShafiurRahman. 2007. Handbook of Food Preservation, 2nd Ed. CRC Press, Boca Raton, FL, USA.*

3) *James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.*

4) *Fellows P. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, Boca Raton, FL, USA.*

5) *William C. Frazier and & Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.*

6) *Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer. 2008. Handbook of Nutrition and Food, 2nd Ed. CRC Press, Boca Raton, FL, USA.*

7) Sehgal, S. and Raghuvanshi, R.S. (2007) Text Book of Community Nutrition. ICAR, New Delhi.

8) Agarwal, A and Udipi, S. (2014). Text Book of Human Nutrition. Jaypee Medical Publication, Delhi.

9) *Peter Zeuthen and Leif Bùgh-Sùrensen. 2003. Food Preservation Techniques. CRC Press LLC, Boca Raton, FL, USA.*

***10)*** *Joshi V.K. and Ashok Pandey. 1999. Biotechnology: Food Fermentation – Microbiology, Biochemistry and Technology, Vol. II. Educational Publishers & Distributors, New Delhi.*

11) *George J. Banwart. 1989. Basic Food Microbiology, 2nd Ed. Chapman & Hall, New York, USA.*

12) Kalia, M. and Sood, S. (2010). Food Preservation and Processing. Revised Edition, Kalyani Publishers, New Delhi.

13) *Swaminathan, M. (1999. Food Science, Chemistry and Experimental Foods. 2nded. The Banglore Printing and Publishing Co., Bangalore.*

| ***Course :*** | *ELE AGM 361* | | ***Credit:*** | *2(1+1)* | ***Semester-VI*** |
|---|---|---|---|---|---|
| ***Course title:*** | *System Stimulation and Agro-advisory* | | | | |

## Syllabus

### Theory

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; 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. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars and forewarning model; 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 agroadvisory.

## *Teaching Schedule*

### *a) Theory*

| Lecture | Topic | Weightage(%) |
|---|---|---|
| 1-2 | System Approach for representing soil-plant-atmospheric continuum | 6 |
| 3 | System boundaries for representing soil-plant-atmospheric continuum | 4 |
| 4-5 | Crop models, concepts and techniques | 6 |
| 6-7 | Types of models, data requirements, relational diagrams | 6 |
| 8-9 | Evaluation of crop responses to weather elements | 4 |
| 10-11 | Elementary crop growth models –calibration and validation | 6 |
| 12-13 | Elementary crop growth models -verification and sensitivity analysis | 4 |
| 14 | Potential and achievable crop production- concept | 4 |
| 15 | Modelling techniques for potential and achievable crop production estimation | 6 |
| 16-17 | Crop production in moisture and nutrients limited conditions | 4 |
| 18 | Components of soil water and nutrient balance | 2 |
| 19-20 | Weather forecasting, its types, methods and tools | 4 |
| 21 | Techniques of weather forecasting and its verification | 6 |
| 22 | Value added weather forecast | 2 |
| 23-24 | ITK for weather forecast and its validity | 3 |
| 25 | Aerospace science and weather forecast | 6 |
| 26 | Crop-Weather Calendar, Crop-Weather-Pest-Disease Calendar and forewarning model | 4 |
| 27 | Crop weather diagram | 4 |
| 28-29 | Remote sensing- its application in agriculture | 6 |
| 30 | Preparation of agro-advisory bulletin based on weather forecast | 4 |

| Lecture | Topic | Weightage(%) |
|---|---|---|
| 31 | Use of crop simulation model for preparation of Agro-advisory | 5 |
| 32 | Agro-advisory , its effective dissemination | 4 |

***b) Practical***

| Exercise | Topic |
|---|---|
| 1 | Preparation of crop weather calendars |
| 2-3 | Preparation of agro-advisories based on weather forecast using various approaches |
| 4 | Preparation of AAS based on weather forecast using synoptic charts |
| 5-6 | Study of crop-weather models using different statistical teqniques |
| 7 | Study of simulation models for crop-growth (DSSAT) |
| 8-9 | Study of forewarning models for insect pest and disease. |
| 10 | Study of crop-weather –pest - disease calendar |
| 11 | Study of Simulation with limitations of water and nutrient management options |
| 12 | Sensitivity analysis of varying weather and crop management practices |
| 13-14 | Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast |
| 15-16 | Feedback from farmers about agro-advisory. |

## Suggested Readings:


1) *Applied Agroclimatology by O.P.Bishnoi, Oxford Book Company, Jaipur, India-302108, Edition 2010.*
2) *Working with Dynamic crop models, Evaluation, Analysis, Parametrization and Applications by D. Wallach, D. Makowshi, J. W. Jones, Elsevier Oxford U.K, First edition 2006.*
3) *Remote Sensing Techniques in Agriculture by D.D.Sahoo, R.M.Solanki, Agrobios (India), Jodhpur, 2008.*
4) *Compendium on Crop Moddeling,by M.C. Varshneya and S.S.Salunke. A short Term Training Programme organized by Centre of Advance Studies in Agril. Meteorology, College of Agriculture, Pune-411005 during 14$^{th}$ Sep., - 12$^{th}$ Oct., 1998, Published by MPKV, Rahuri MPKV/EDN./PUB No. 10(99).*
5) *Database Management Systems by R. Ramkrishnan, Johannes Gehrke, M.C.Grawhill Education (India) Pvt.Ltd, New Delhi, Indian Edition 2014.*
6) *Introduction to Agrometeorology (Second Edition) by H.S.Mavi, Oxford and IBH Publishing Co. Pvt.Ltd., New Delhi, 1994.*
7) *Text book of Agril. Meteorology by M.C. Varshneya, P. BalakrishnaPillai, ICAR New Delhi, 2003.*

Basic Principles of Agril. Meteoorology by V.Radhakrishna Murthy, BS Publication, Hyderabad, 2002.