

B.Voc. Degree Course
in
SUSTAINABLE AGRICULTURE
under
CREDIT AND SEMESTER SYSTEM AND GRADING

Scheme for the Distribution of Credits, Period of
Instruction and Syllabus

AIMS AND OBJECTIVES OF VOCATIONAL EDUCATION

AIM

The University Grants Commission (UGC) has launched a scheme on skills development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) Degree with multiple exits such as Diploma/Advanced Diploma under the NSQF. The B.Voc. programme is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles and their NOSs alongwith broad based general education. This would enable the graduates completing B.Voc. to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

The main objectives of the scheme are:

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such

graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.

- To provide vertical mobility to students coming out of 10+2 with vocational subjects.

OBJECTIVES OF THE B.Voc. COURSE IN SUSTAINABLE AGRICULTURE

- To propagate the ideas, practices and policies that constitutes the concept of sustainable agriculture.
- To provide a thorough view of the consequences of farming practices on both human communities and the environment.
- To empower the students with an economically viable, socially supportive and ecologically sound education on agriculture.
- To provide education that emphasizes topography, soil characteristics, climate, pests, local availability of inputs and the individual grower's goals.

ELIGIBILITY

A pass in plus-two (Science group) or equivalent examinations (V.H.S.C.) recognized by the University.

DURATION OF THE COURSE

The course will be a **six semester full time programme** extending **three academic years** consisting of 90 working days of instruction in each semester including examination.

PROGRAMME

The programme is grouped under the Model III - New Generation Courses.

COURSE STRUCTURE

The curriculum is a suitable mix of **General Education** and **Skill Development** components. The General Education components emphasize and offer courses which provide holistic development. The focus of Skill Development components is to equip students with appropriate knowledge, practice and attitude, so as to become work ready. While designing the curriculum of Skill Development components, adequate attention has been given to

practical work, industrial visit, internship, development of student portfolios and project work.

COURSE

The diploma has **38 skill development courses, 20 general education courses (including one choice based course and one open course) 6 skill development internships and one skill development project. The total credits is 180 for the entire programme.**

(One Credit is equivalent to 18 periods of 60 minutes each, for theory, workshops/labs and tutorials. For internship/field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops.)

COURSE CODE

The following methodology is adopted for course codes.

(SAG-Sustainable Agriculture, FPR- Food Processing, EES-Energy and Environmental Studies, 1- First Semester, S-Skill Development, 1T-First Theory Paper, 2T- Second Theory Paper, P- Practical, G-General Education, I-Internship / training.)

EXAMINATIONS

The evaluation of each course shall contain two parts such as internal or In-Semester Assessment (ISA) and External or End-Semester Assessment (ESA). The external examination of all semesters shall be conducted at the end of each semester. Internal evaluation is to be done by continuous assessment. The ratio between internal and external examinations shall be 1:4. There shall be a maximum of 80 marks for external evaluation and maximum of **20** marks for internal evaluation. For all courses (theory & practical), grades are given on a 07-point scale based on the total percentage of marks. **(ISA+ESA)** as given below.

Percentage of Marks	Grade	Grade Point
90 and above	A+ - Outstanding	10
80-89	A - Excellent	9

70-79	B - Very Good	8
60-69	C - Good	7
50-59	D - Satisfactory	6
40-49	E - Adequate	5
Below 40	F - Failure	4

Note: Decimal are to be rounded to the next whole number

Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

For all courses without practical

- a) Marks of external Examination : 80
- b) Marks of internal evaluation : 20

Components of Internal Evaluation	Marks
Attendance	5
Assignment /Seminar/Viva	5
Test paper(s) (1 or 2) (1x10=10; 2x5=10)	10
Total	20

For all courses with practical

- a) Marks of theory –External Examination : 60
- b) Marks of theory –Internal Evaluation : 10

Components of Theory – Internal Evaluation	Marks

Attendance	3
Assignment	2
Test paper(s) (1 or 2) (1x5=5; 2x2.5=5)	5
Total	10

c) Marks of Practical –External Examination : 40

d) Marks of Practical- Internal Evaluation : 20

Components of Practical- Internal evaluation	Marks
Attendance	4
Record	10
Lab involvement	6
Total	20

Attendance Evaluation

1) For all courses without practical

% of attendance	Marks
90 and above	5
85 – 89	4
80-84	3
76-79	2
75	1

2) For all courses with practical

% of Attendance	Marks for theory
90 and above	3
80--89	2
75--79	1

% of Attendance	Marks for practical
90 and above	4
85--89	3
80--84	2
75--79	1

Assignments

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester.

Project Evaluation: (Max. marks100)

Components of Project-Evaluation	Marks
Internal Evaluation	20
Dissertation (External)	50
Viva-Voce (External)	30
Total	100

Credit point and Credit point average

Grades for the different Semesters and overall Programme are given based on the corresponding CPA, as shown in below

Credit point (CP) of a Course is calculated using the formula

$$CP = C \times GP, \text{ where } C = \text{Credit}; GP = \text{Grade Point}$$

Credit Point Average (**CPA**) of a Semester or Programme etc. is calculated using the formula

$$\text{CPA} = \frac{\text{TCP}}{\text{TC}}, \text{ where TCP = Total Credit Point;}$$

TC = Total Credit

CPA	Grade
above 9	A+ - Outstanding
above 8 but ≤ 9	A - Excellent
above 7 but ≤ 8	B - Very Good
above 6 but ≤ 7	C - Good
above 5 but ≤ 6	D - Satisfactory
above 4 but ≤ 5	E - Adequate
≤ 4	F - Failure

SEMESTER-I
SAG1S1T- Fundamentals of Agronomy

Credits: 3

54 Hrs

Objectives:

- To enable the students to acquire knowledge on importance of agriculture and various types of farming.
- To study the fundamentals of agronomy and classification of field crops.

MODULE 1

6 Hrs

Importance of agriculture in India and Kerala, Hunger and food security, Agronomy, Sustainable agriculture, Subsistence agriculture, commercial agriculture, Extensive and intensive agriculture, Peasant farming, Urban agriculture, Agribusiness, Agricultural seasons in India and Kerala, Rainfed and irrigated agriculture.

MODULE 2

12 Hrs

Agricultural classification of crops, Agronomic classification of crops, Botanical classification of crops, Major farming systems in Kerala and Cropping Intensity, Methods of sowing/planting - planting geometry and its effect on growth and yield.

MODULE 3

12 Hrs

Soil and climatic requirements, varieties, cultural practices, special systems of cultivation, harvesting and processing of major cereals and millets, pulses, tubercrops, rice, maize, finger millet, cowpea, tapioca, sweetpotato, amorphophallus, yams, coleus, arrowroot etc

MODULE 4

12 Hrs

Soil productivity and fertility. - Crop nutrition - nutrients -classification - Nutrient sources- organic manures -fertilizers - biofertilizers .Nutrient recycling through manures and fertilizers - organic manures. Fertilizers and fertilizer use- management of fertilizers .Biological nitrogen fixation, Green manure crops and cover crops .Integrated Nutrient Management.

MODULE 5

12 Hrs

Irrigation: definition and objectives. Role of water in soil and plants- Irrigated agriculture vs. Rainfed agriculture, dry farming and dryland farming- definition. Water resources and in India and Kerala. Irrigation methods - drip and sprinkle irrigation systems. Water management of different crops like rice, banana, coconut, cowpea, and vegetables.

Text Books:

1. Balasubramaniyan, P and Palaniappan, S.P. 2001. *Principles and Practices of Agronomy*

AgroBios(India)Ltd., Jodhpur.

2. Cox, G.W and Atkins, M.D. 1979. *Agricultural Ecology : An Analysis of World Food Production Systems*. W.H. Freeman and Company, San Francisco
3. De, G.C.1989.*Fundamentals of Agronomy*. Oxford & IBH Publishing Co., New Delhi.
4. Grigg, D.B. 1974. *The Agricultural Systems of the World: An Evolutionary Approach*. Cambridge University Press, Cambridge.
5. Harlan, J.R. 1992. *Crops and Man*. American Society of Agronomy& Crop Science Society of America, Madison, WI.
6. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelsothn, W.L. 2006. *Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7 ed.)*. Pearson Education, Delhi.
7. ICAR.2006. *Hand book of Agriculture*, ICAR, New Delhi.
8. Janick, J., Schery, R.W., Woods, F.W., and Ruttan, V.W. 1974. *Plant Science: An Introduction to World Crops*. W.H. Freeman and Company, San Francisco.
9. Noor Mohammed.1992. Origin, diffusion and development of agriculture. In: Noor Mohammed (ed.), *New Dimensions in agricultural geography: Vol.1.Historical Dimensions of agriculture*. Concept publishing Co., New Delhi.pp29-75.
10. Reddy.T.Y and Reddy, G.H.S.1995.*Principles of Agronomy*, Kalyani Publishers, Ludhiana.
11. Chatterjee, B.N. and Maiti, S.1985.*Principles and Practices of Rice Growing*. Oxford & IBH Publishing Co., New Delhi.

SAG1S1P- Fundamentals of Agronomy - Practical

Credits: 2

36 Hrs

Objectives

- To familiarize with cultivation aspects of cereals and millets, pulses and tubercrops.

1. Identification of cereals and millets, pulses, and tuber crops. **3 Hrs**
2. Different methods of sowing; direct seeding: broadcasting, dibbling and drilling-transplantation. **5 Hrs**
3. Seed treatment - *Rhizobium* inoculation of leguminous crops. **4 Hrs**
4. Identification of manures -organic manures: bulky and concentrated manures Fertilizers: Straight, complex and mixed fertilizers - identification and preparation. **5 Hrs**
5. Fertilizer recommendation and calculation for major cereals and pulses. **5 Hrs**
6. Familiarization with green manure crops and cover crops. **5 Hrs**

7. Practice of methods of fertilizer applications- broadcasting, placement, foliar application and fertigation. **5 Hrs**

8. Yield estimation of crops- biological yield and economical yield. **4 Hrs**

SAG1S2T- Fundamentals of Horticulture

Credits: 3 **54 Hrs**

Objectives

- To acquaint with importance, division and classification of horticultural crops.
- To understand the basic principles and types of plant propagation.

MODULE 1 **10 Hrs**

Horticulture - definition, importance, division and classification of horticultural crops. Importance of horticulture in India and Kerala. Orchard planning, layout, planting systems - management practices. Tree forms and functions - Training and pruning in horticultural crops - principles and methods, techniques of training and pruning, fruit thinning.

MODULE 2 **10 Hrs**

Phases of growth and development - vegetative/ reproductive balance; Flowering in plants - bearing habit and its classification- factors associated with flowering and fruit set. Fruit set and development - structure and process concerned with setting. Fruit drop - factors affecting and control measures - unfruitfulness - internal and external factors. Seedlessness in horticultural crops; significance and induction.

MODULE 3 **10 Hrs**

Plant propagation - definition and basic concepts, sexual and asexual types - advantages and disadvantages. Media, containers, potting, re potting and pre planting treatments. Asexual propagation - propagation by cuttings, types of cuttings, factors affecting rooting of cuttings. Propagation by layering - types of layering.

MODULE 4 **12 Hrs**

Propagation by grafting - methods of grafting - development of graft unions, separation and after care. Stock-scion relationship - Graft incompatibility - factors affecting incompatibility. Propagation by budding, methods of budding - A comparative study between grafting and budding.

MODULE 5 **12 Hrs**

Nursery - site selection, layout - components of a nursery - production unit, sales unit, display

area, management and maintenance, propagation unit - close planted progeny orchards. Plant propagating structures-.greenhouse, glasshouse, hot bed, cold frame, lath house, net house, mist chamber.

Text books:

1. Bose, TK., Mitra, SK. and Sadhu, K. 1986.*Propagation of tropical and subtropical horticultural crops*.NayaProkash, Calcutta.
2. Denixon, RI. 1979. *Principles of Horticulture*. Mac Millan, New York.
3. Edmond, JB., Sen, TD, Andrews, TS and Halfacre, RG. 1977. *Fundamentals of Horticulture*. Tata McGraw Hill, New Delhi.
4. Hartmann, HT. and Kester, DE.1986.*Plant propagation - Principles and practices*.Prentice-Hall, New Delhi.
5. Leopold, A.C. and Kriedeman, P.E. 1975.*Plant Growth and Development*. Tata McGrawHill Publishing Co. Ltd., New Delhi.
6. Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Delhi.Choudhury, B.1983. Vegetables. National Book Trust, New Delhi.
7. Das, P. C.1993. Vegetable crops in India.Kalyani Publishers
8. Gopalakrishnan, T. R. 2007. Vegetable Crops.New India Publishing Agency, New Delhi.
9. Hazra, P. and Som, M. G. 1999. Technology for vegetable Production and Improvement.NayaProkash, Calcutta
10. Peter, K. V. 1998. Genetics and Breeding of vegetables. ICAR, New Delhi.

SAG1S2P-Fundamentals of Horticulture -Practical

Credits: 2

36 Hrs

Objectives

- To develop skill in propagation and cultivation aspects of horticultural crops.

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|---|--------------|
| 1. Familiarization to Different planting systems and layout | 5 Hrs |
| 2. Propagation methods - sexual propagation -seed viability tests, dormancy breaking methods. | 4 Hrs |
| 3. Propagation structures - mist chamber, green house, hot beds etc. | 6 Hrs |
| 4. Propagation by cuttings. | 5 Hrs |
| 5. Propagation by layering - types of layering. | 4 Hrs |
| 6. Propagation by grafting - methods of grafting | 6 Hrs |

7. Propagation by budding, methods of budding **6 Hrs**

SAG1S3T-Fundamentals of Entomology and Insect ecology

Credits: 2 **36 Hrs**

Objectives

- To familiarize with insect pests and to understand about the Insect ecology

Module 1 **8 Hrs**

History of Entomology. Classification of phylum Arthropoda. Relationship of class Insecta with other classes of Arthropoda. Insects in relation to man - Factors for insect abundance and success. Morphology –Grasshopper/Plant bug, structure and functions of insect cuticle, Moulting. Body segmentation. Structure of Head, thorax and abdomen .Structure and modifications of insect mouth parts. Types of insect larvae and pupae.

Module 2 **6 Hrs**

Insect orders of agricultural importance- Lepidoptera, coleoptera, hemiptera, diptera and hymenoptera.

Module 3 **8 Hrs**

Insect Ecology- introduction. Environment and its components. Population dynamics- effect of abiotic factors- temperature, moisture, humidity, Rainfall, light, atmospheric pressure and air currents. Effect of biotic factors - food, natural enemies.

Module 4 **7 Hrs**

Concepts of Balance of life in nature, biotic potential and environmental resistance. Pests - definition, categories of pests, causes for pest outbreak. Losses caused by pests.

Module 5 **7 Hrs**

Identification, symptoms of damage caused by pests of Rice, Coconut, Banana, Pepper, cardamom, Brinjal, Bittergourd and cowpea. Nematode Pests of crops, Common Pests of stored food products/grains. Pest monitoring - Pest surveillance and pest forecasting. Assessment of pest population and damage.

Text books:

1. Mani, M. S. 1968. General Entomology. Oxford and IBH Publishing Company, New Delhi.
2. Nayar, K. K., Ananthakrishnan T. N. and David.B.V. 1976. General and Applied Entomology, Tata McGraw Hill Publishing Company Limited, New Delhi, 589p.

3. Pedigo, L. P. 1999. Entomology and Pest Management. Third Edition. Prentice Hall, New Jersey, USA.
4. Richards, O.W. and Davies, R. G. 1977. Imm's General Text Book of Entomology, Vol.1&2, Chapman and Hall Publication, London.
5. Srivastava, P. D. and Singh, R. P. 1997. An Introduction to Entomology, Concept Publishing Company, New Delhi.
6. Dhaliwal, G. S. and Ramesh Arora. 1998. Principles of Insect Pest Management. Kalyani Publishers, New Delhi.

SAG1S3P-Fundamentals of Entomology and Insect ecology

Credits: 2

36 Hrs

Objectives

- To develop skill in different IPM practices in insect pest management and to familiarize with insect morphology

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|--|--------------|
| 1. Types of insect mouthparts. | 4 Hrs |
| 2. Structure and modifications of insect antennae | 3 Hrs |
| 3. Structure and modifications of insect legs | 3 Hrs |
| 4. Types of insect larvae and pupae. | 3 Hrs |
| 5. Identification of different types of insect damages on crop plants | 4 Hrs |
| 6. Identification, symptoms of damage, collection and preservation of pests of Rice, Coconut, Banana, Pepper, cardamom, Brinjal, Bittergourd and cowpea. | 8 Hrs |
| 7. Identification of Pests of stored food grain/products | 3 Hrs |
| 8. Sampling techniques for the estimation of insect population in selected crops | 4 Hrs |
| 9. Estimation of insect damage in selected crops | 4 Hrs |

ENCN1- Communication Skills in English

(Adopted from existing M. G. University Syllabus)

Credits: 6

90 Hrs

Objectives

- To introduce the students to the speech sounds of English in order to enable them to listen to English and speak with global intelligibility.
- To enable the students to speak English confidently and effectively in a wide variety of situations.

- To help the students to improve their reading efficiency by refining their reading strategies.

Module 1– I Speech Sounds

18 Hrs

Phonemic symbols - Vowels - Consonants - Syllables - Word stress - Stress in polysyllabic words – Stress in words used as different parts of speech - Sentence stress – Weak forms and strong forms – Intonation – Awareness of different accents: American, British and Indian – Influence of the mother tongue

Module 2 - Listening

18Hrs

Active listening – Barriers to listening – Listening and note taking– Listening to announcements – Listen-ing to news on the radio and television

Module 3 Speaking

36 Hrs

Word stress and rhythm – Pauses and sense groups – Falling and rising tones – Fluency and pace of deliv-ery – Art of small talk – Participating in conversations – Making a short formal speech – Describing people, place, events and things – Group discussion skills and telephone skills.

Module 4 Reading

18 Hrs

Reading: theory and Practice – Scanning - Surveying a textbook using an index - reading with a purpose – making predictions – Understanding text structure – Locating main points – Making inferences - Reading graphics - reading critically – Reading for research.

Text books:

1. V.Sasikumar, P Kiranmai Dutt and Geetha Rajeevan, Communication Skills in English. Cambridge University Press and Mahatma Gandhi University.
2. A Course in Listening and Speaking I & II, Sasikumar, V. Kiranmai Dutt and Geetha Rajeevan, New Delhi: CUP, 2007.
3. Study Listening: A Course in Listening to Lectures and Note-taking Tony Lynch New Delhi: CUP.
4. Study Speaking: A Course in Spoken English for Academic Purposes. Anderson, Kenneth, Joan New Delhi: OUP, 2008.
5. Study Reading: A Course in Reading Skills for Academic Purposes, Glendinning, Eric H. and Beverly Holmstrom New Delhi: CUP, 2008.
6. Communication Studies. Sky Massan Palgrave, Macmillan. Effective Communication for Arts and Humanities Students Joan Van Emden and Lucinda Becker Palgrave Macmillan.

7. Effective Communication for Arts and Humanities Students Joan Van Emden and Lucinda Becker
Palgrave Macmillan.

SAG1S11-Setting up of crop museum

Credits: 4

Objectives

- To develop skill in setting up of a crop museum for major field crops

Work plan:

Familiarisation with main field preparation, sowing/planting, nutrient management and other intercultural operations of major field crops such as cereals, millets and tuber crops, by allotting each student an area of 40 m² (1 Cent).

SEMESTER-II

SAG2S1T- Plantation Crops, Spices and Fruits

Credits: 3

54 Hrs

Objectives

- To acquaint with the cultivation aspects of Plantation crops, spices and fruit crops.

Module 1

12 Hrs

Plantation crops, Introduction - importance - area, production - origin, distribution - botany, varieties - climate, soil, site selection - propagation, production of quality planting materials and hybrids - nursery management - layout, planting, aftercare - irrigation, manuring - stage of harvest, harvesting, yield and uses of :-coconut and Rubber.

Module 2

10 Hrs

Plantation crops, Importance - area, production - origin, distribution - botany, varieties - climate, soil, site selection - propagation, production of quality planting materials and hybrids - nursery management - layout, planting, aftercare - irrigation, manuring - stage of harvest, harvesting, yield and uses of cashew, tea and coffee.

Module 3

12 Hrs

Spices, Definition - classification - importance to the state. Origin - distribution - area, production .varieties - climate, soil - propagation, nursery management - site selection, layout, planting - crop management including manuring, irrigation, shade regulation, harvesting, yield of the following crops: Pepper, cardamom, ginger, and nutmeg.

Module 4

15 Hrs

Fruits, Importance and scope of commercial fruit production - Global scenario of fruit production and export - Present status of fruit production in the state and in the country - problems and prospects. Crop management practices - selection and preparation of planting materials, field preparation and planting, manuring, irrigation, weed management, use of bio-regulators, other cultural operations. Cultural practices for quality improvement. Maturity indices, harvesting, grading, packing, storage and ripening techniques. Industrial and export potential- of Crops-Banana, mango, and pineapple.

Module 5

5 Hrs

Fruits, Management practices of crops gaining importance in the state recently (mangosteen, rambutan, durian).

Text books:

1. Chadha, K.L. 2001. Hand Book of Horticulture, ICAR, New Delhi.
2. Kumar, N., Abdul Khader, J.B.M., Rangaswami, P. and Irulappan., 1993. Introduction to spices
3. Menon, K.P.V. and Pandalai, K.M. 1960. The coconut Palm - a monograph. Indian Central Coconut Committee, Ernakulam.
4. Pursglove, J.W., Brown, E.G., Green, C.L. and Robbins, S.R.G. 1981. Spices Vol-I & II.
5. Pruthi, J.S. 1993. Major Spices of India, Crop Management - Post Harvest Technology, ICAR, New Delhi.
6. Pruthi, J.S. 2001. Minor Spices and Condiments - Crop Management and Post Harvest Technology, ICAR, New Delhi, India.
7. Amar Singh, 1986. Fruit Physiology and Production. Kalyani Publishers, New Delhi.
8. Bose, T.K., Mitra, S.K. and Sanyal, D. 2002. Fruits: Tropical and Subtropical. Vol. I & II, Nayaprakash publications, Calcutta.
9. Hayes, W.B. 1957. Fruit Growing in India. Kitabitan, Allahabad.
10. Kumar, N. 1997 (6th Edition). Introduction to Horticulture. Rajhalakshmi Publications, Nagercoil
11. Mitra, S.K., Bose, T.K. and Rathore, D.S. 1991. Temperate Fruits. Horticulture and Allied Publishers, Calcutta.
12. Naik, K.C. 1949. South Indian Fruits and Their Culture. Varadachari Co., Madras.
13. Samson, J.A. 1980. Tropical Fruits. Longman group, London.

AG2S1P-Plantation Crops, Spices and Fruits- Practical

Credits: 2

36 Hrs

Objectives

- To acquire skill on cultivation aspects of Plantation crops, spices and fruit crops

Plantation Crops

14 Hrs

- Coconut: Nursery techniques, Seedling selection, Production of quality planting materials and hybrids and mother palm selection,
- Familiarization with varieties, Moisture conservation methods in coconut plantations.
- Layout and planting, care and management of plantations.
- Tapping systems in rubber.
- Training and pruning in tea, coffee.

Spices

10 Hrs

- Morphology, nursery techniques, planting in main field, cultural operations and harvesting of pepper, cardamom, ginger, nutmeg

Fruits (Banana, Pineapple and Mango.)

12 Hrs

- Familiarization with important varieties. Practice in propagation, selection of good planting materials, field preparation and planting, manuring and use of growth regulators. Familiarization with weedicides, and plant protection chemicals. Studies on major pests, diseases and nutritional disorders. Studies on maturity indices and storage.
- Visit to research stations, farmers' field, marketing outlets and processing units.

SAG2S2T-Fundamentals of Plant Breeding and Seed technology

Credit: 2

36 Hrs

Objectives

- To familiarize with the fundamentals of plant breeding.
- To familiarize with the basics of seed technology.

Module1: Morphology and systematics of crop plants

6 Hrs

General features of important families - morphology of roots, stem, leaves, flowers, fruits and seeds. Introduction to field crops - Classification of field crops. Botany and economic importance of crops like Rice, Ragi, Cowpea, Bitter Gourd, Cucumber, Brinjal, Chilli, Tomato,

Soyabean, coconut, Groundnut, Gingelly, Tapioca, Cotton, Sweet potato, Rubber, Mango, Cashew, Pepper, Papaya and Banana.

Module 2: Principles of plant breeding

8 Hrs

Aims, objectives and importance of Plant Breeding; Modes of reproduction, Sexual, Asexual, Apromixis and their classification; Modes of pollination, genetic consequences, differences between self and cross pollinated crops; Methods of breeding - introduction and acclimatization. Selection, Mass selection, Johannson's pure line theory, Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, pedigree method, bulk method, back cross method; Breeding objectives and concepts of breeding in self pollinated, cross pollinated and vegetatively propagated crops. (Clonal selection; Mutation breeding; Ploidy breeding). Breeding of Cereals – rice. Pulses- cow pea. Oil seeds - ground nut. Vegetables-Tomato, bhindi. Fruit crops- mango. Plantation crops - Coconut. Breeding procedures for development of hybrids, / varieties of various crops.

Module3: Principles of genetics

4 Hrs

Mendel's laws of inheritance and exceptions to the laws, Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits and Qualitative traits; Multiple factor hypothesis: Cytoplasmic inheritance - important features and difference from chromosomal inheritance; Linkage and crossing over

Module 4: Intellectual property rights

4 Hrs

Plant genetic resources- conservation and utilization. Biodiversity Act and its Implications, Exchange of germplasm, Material Transfer Agreement International treaties on plant genetic resources. IPR - definition, concepts, and components. - Plant breeders rights and farmers rights. UPOV, PPV and FR act. Plant variety registration Concept of Geographical Indications

Module 5: Principles of Seed Technology

14 Hrs

Introduction to Seed Production, Importance of Seed Production, The concept of a seed- definition-structure of a seed-seed development process, Definition, Characters of good quality seed, Factors affecting seed quality - ecological influences, packing practices, harvest and post harvest handling, Genetic and agronomic principles of seed production, Seed testing procedures for quality assessment- Physical, Purity, germination and viability test, Principles of establishing a seed testing laboratory, Post harvest seed management techniques seed extraction-seed processing- drying-cleaning-upgrading-seed blending, Dormancy of seed, role of growth regulators in restoring seed viability, physical agents for increased seed germination, seed vigour etc. Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment, Seed packing and seed storage, factors affecting seed

longevity during storage and conditions required for good storage, General principles of seed storage, measures for pest and disease control, temperature control, Seed production of major crops - field crops , plantation crops , fruit plants ,spices, ornamental plants , medicinal plants, Different classes of seeds- Production of nucleus, breeder's seed, foundation and certified seed production, Seed certification, procedure for seed certification, field inspection and field counts etc., Seed Legislation - Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Seed Act 2000 and other issues related to seed quality regulation, Organizations involved in seed production i.e., public, quasi, co operative, private etc. Planning seed production programme- seed farm organization-procurement and pricing policy-economics of seed production of different crops; government policy in seed production and study of export potential of seeds.

Text books:

1. Albert F-Hill and O.P. Sharma, 1996.Economic Botany. Tata McGraw - Hill Publishing Company Ltd., New Delhi
2. Chalam, G.V., J. Venkateswarlu. 1966. Agricultural Botany in India-Vol. 1. Asia publishing house, Bombay, New Delhi
3. Daniel Sundararaj, D and G. Thulasidas, 1993. Botany of field crops. Macmillan India Ltd., New Delhi
4. Allard, R.W. 1960. Principles of Plant Breeding.John Wiley & Sons INC. USA. Toppan Co. Ltd. Japan
5. 4. Choudhari, T.C. 1982. Introduction to Plant Breeding. Oxford A& IBH Publishing Co., New Delhi
6. 5. Elliot. 1958. Plant Breeding &Cytogenetics. Mc Grow Hill. New York
7. Sharma, J.R. 1989. Principles and Practice of Plant Breeding. Tata McGraw - Hill Publishing Company Limited, New Delhi.
8. Singh, B.D. 2001. Fundamentals of Genetics.Kalyani Publishers. New Delhi. Ludhiana
9. Singh, B.D. 2003. Plant Breeding Principles and Methods.Kalyani Publishers.New Delhi/ Ludhiana.
7. Agrawal, R.L. 1995. *Seed Technology*. Oxford, IBH Publishing Co., New Delhi.
8. Bose, T. K. and Som, M. G. 1990. Vegetable crops in India.NayaProkash, Calcutta.
9. Das, P. C.1993. Vegetable crops in India.Kalyani Publishers
10. Dahiya, B.S and Rai, K.N., 1997. *Seed Technology*, Published by Kalyani Publishers,

Chennai.

SAG2S2P-Fundamentals of Plant Breeding and Seed technology-Practical

Credit: 2

36 Hrs

Objectives

- To familiarize with the botanical aspects of field crops.
- To develop skill in various aspects of seed production.

1. Plant breeding

18 Hrs

2. Introduction to field crops and agricultural classification of field crops.
3. Observing general morphology of roots, stem , leaves, inflorescence, flowers
4. Family characters and Botany and economic parts of the crop plants
5. Microscopy
6. Preparation and use of fixatives and stains for light microscopy
7. Preparation of micro slides
8. Identification of various stages of cell division
9. 8.Fertilization and life cycle of an angiospermic plant
10. Floral morphology, selfing, emasculation and crossing technique

Seed Technology

18 Hrs

11. Identification of seeds of summer vegetables and cool season vegetables
12. Seed sampling principles and procedures
13. Physical purity analysis of seeds
14. Seed Testing: Germination analysis and viability analysis of seeds
15. Seed dormancy and breaking methods
16. 6.Techniques of hybrid seed production in tropical vegetables
17. Seed extraction techniques
18. Seed treatment against systemic diseases
19. Seed production in rice, Hybrid seed production in rice , coconut
20. Visit to seed production plots
21. Visit to seed processing plants
22. Visit to seed testing laboratories.

SAG2S3T- Fundamentals of Agricultural Engineering

Credit: 2

36 Hrs

Objectives

- To familiarize with fundamentals of water management.
- To acquaint with various soil conservation methods.

MODULE 1

7 Hrs

Irrigation: definition and objectives. Role of water in soil and plants- Irrigated agriculture vs. Rainfed agriculture, dry farming and dryland farming-definition.

MODULE 2

10 Hrs

Evapo-transpiration, potential evapo-transpiration and consumptive use, Reference crop evapo-transpiration (ET_o) - Crop co-efficient (K_c) - K_c values for different crops. Methods of determining water requirement-effective rainfall. Methods of irrigation and their engineering aspects - surface irrigation, sprinkler, drip - Agronomic techniques to improve water use efficiency- factors affecting water use efficiency.

MODULE 3

7 Hrs

Soil erosion- nature and extent of erosion; types- soil erosion by water- different forms- Soil conservation vs. water conservation - agronomic measures- mechanical measures- Role of grasses and pastures in soil conservations; Wind breaks and shelter belts.

MODULE 4

6 Hrs

Water harvesting techniques - in situ and ex situ water harvesting methods - Farm ponds, percolation ponds or wells, check basin, minor irrigation tanks.

MODULE 5

6 Hrs

Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields.

Text books:

1. Dhruvanarayana, V.V. 1993.*Soil and Water Conservation Research in India*. ICAR, New Delhi.
2. Gurmel Singh, C. Venkataraman, G., Sastry, B. and Joshi, P. 1990.*Manual of Soil and Water Conservation Practices*. Oxford and IBH Publishing Co., New Delhi.
3. Hansen, V.Eh., Israelsen, O.W., and Stringham, G.E. 1979. *Irrigation Principles and Practices* (4th Ed.). John Wiley and Sons, New York.

4. Lenka, D. 2001.*Irrigation and Drainage*. Kalyani Publishers, New-Delhi.
5. Mal, B. C.2002.*Introduction to Soil and Water Conservation Engineering*, KalyaniPublishers, New-Delhi.
6. Michael, A.M and Ojha, T.P. 2005.*Principles of Agricultural Engineering-Vol.II*.Jain Brothers, New Delhi.
7. Michael, A.M. 1988.*Irrigation Theory and Practice*.Vikas Publishing House Pvt. Ltd., New Delhi.

SAG2S3P- Fundamentals of Agricultural Engineering-Practical

Credit: 3 **54 Hrs**

Objectives

- To familiarize with fundamentals of water management measures
- To acquaint with various soil conservation methods

- | | |
|---|---------------|
| 1 Basic calculations for water management | 5 Hrs |
| 2. Determination of soil moisture by thermo-gravimetric method and volumetric methods | 8 Hrs |
| 3. Methods of irrigation - border strip, check basin, ring, and corrugation furrow | 8 Hrs |
| 4. Drip and sprinkler irrigation, components, design aspects -Erection and operation of drip and sprinkler irrigation system; | 10 Hrs |
| 5. Cost estimation of drip irrigation system; fertigation, injection and flushing of laterals; | 6 Hrs |
| 6. Studies of different engineering measures of soil conservation | 8 Hrs |
| 7. Visit to a water management research station | 9 Hrs |

ENCN2 - Critical Thinking, Academic Writing and Presentation

(Adopted from existing M. G. University Syllabus)

Credits: 6 **90 Hrs**

Objectives

- To make the students aware of the fundamental concepts of critical reasoning and to enable them to read and respond critically, drawing conclusions, generalizing, differentiating fact from opinion and creating their own arguments.

- To assist the students in developing appropriate and impressive writing styles for various contexts.
- To help students rectify structural imperfections and to edit what they have written.
- To equip students for making academic presentations effectively and impressively.

Module 1 Critical Thinking **18 Hrs**

Introduction to critical thinking – Benefits - Barriers – Reasoning—Arguments - Deductive and inductive arguments – Fallacies - Inferential comprehension- Critical thinking in academic writing - Clarity - Accuracy – Precision - Relevance

Module 2 Research for Academic Writing and the Writing Process **18 Hrs**

Data collection - Use of print, electronic sources and digital sources—selecting key points - Note making, paraphrasing, summary – Documentation - Plagiarism – Title – Body paragraphs - Introduction and conclusion – Revising - Proof-reading

Module 3 Accuracy in Academic Writing **18 Hrs**

Articles - Nouns and prepositions - Subject-verb agreement - Phrasal verbs—Modals - Tenses - Condition-als – Prefixes and suffixes – Prepositions—Adverbs – Relative pronouns - Passives - Conjunctions - Embedded questions - Punctuation – Abbreviations

Module 4 Writing Models **18 Hrs**

Letters - Letters to the editor - Resume and covering letters - e-mail—Seminar papers - Project reports - Notices - Filling application forms—Minutes, agenda - Essays

Module 5 Presentation Skills **18 Hrs**

Soft skills for academic presentations - Effective communication skills – Structuring the presentation - Choosing appropriate medium – Flip charts – OHP - PowerPoint presentation – Clarity and brevity - Interaction and persuasion - Interview skills –Group Discussions

Text books:

1. Marilyn Anderson, Pramod K Nayar and Madhuchandra Sen. Critical Thinking, Academic Writing and Presentation Skills. Pearson Education and Mahatma Gandhi University.

SAG2S11

Cultivation of coconut and banana

Credit: 4

Objectives

To develop skill and to get experience in the cultivation practices of coconut and banana.

Work planned:

Familiarisation with seedling/sucker selection, land preparation, pit making and planting. Nutrient management, irrigation and other intercultural operations, pest and disease management aspects by allotting each student with 2 coconut palms and by planting 10 bananas.

SEMESTER-III

SAG3S1T- Fundamentals of Plant Pathology

Credit: 4

72 Hrs

Objectives

- To understand the general characters of major plant pathogens.
- To acquaint with principles of crop disease management.

MODULE I Introductory plant pathology

25 Hrs

Concept of plant disease- Definition- classification of plant diseases-types of diseases based on symptom. Plant Pathology - introduction - definitions of terminology - bacteria, fungi, viruses, viroids, phytoplasmas, fastidious vascular bacteria, parasites, pathogens, biotrophs, hemibiotrophs, necrotrophs. Pathogenicity, pathogenesis, virulence, infection, inoculum, invasion, colonisation, inoculum potential, symptoms, incubation period. Survival and dispersal of plant pathogens. Phenomenon of infection and pathogenesis. Role of enzymes, toxins, growth regulators and polysaccharides. Disease cycle, disease syndrome, monocyclic diseases, polycyclic diseases, alternate host, collateral host. Predisposition, physiological race, biotype, symbiosis, mutualism, antagonism. General characters of fungi, classification of fungi, methods of reproduction. General characters, taxonomy, somatic structures, reproduction, life cycle and pathological significance of major plant pathogenic fungus. General characters of bacteria- taxonomy, structure, reproduction and plant pathological significance - Characters and classification of phytopathogenic bacteria- symptoms of bacterial

diseases, mode of entry and spread. General characters of Virus - definition- nature, properties, classification, and virus - vector relationships-common symptoms of virus, viroid and phytoplasmal diseases of crops. Characters of algal and phanerogamic plant parasites - symptoms.

MODULE 2: Principles of crop disease management **15 Hrs**

Introduction - importance and history of crop disease management. Epidemiology of crop diseases - weather factors and their role - temperature, rainfall, relative humidity etc. Disease assessment -forecasting - disease modeling. Principles of crop disease management - Importance, general Principles - Avoidance - Exclusion – protection. Plant Quarantine and Inspection -Rules and Regulations.

MODULE 3 Strategies of Plant Disease management **16 Hrs**

1. Cultural control-Roguing, eradication of alternate and collateral hosts, crop rotation, mixed cropping manure and fertilizer management. Sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage. Biological control - Role and mechanisms of biocontrol agents and PGPR. Physical Methods - soil solarisation, heat treatment etc. Chemical methods -Fungicides -classification - chemical groups of fungicides - inorganic, organic, systemic, antibiotic etc., Methods of application of fungicides - seed, soil, foliar spray, post harvest treatment, root feeding etc Fungicide formulations - Characteristics of an ideal fungicide. Compatibility and phytotoxicity of fungicides. Plant disease resistance - types of resistance - vertical and horizontal - Defense mechanism in plants - Structural and Bio- chemical (pre and post- infection) cross-protection.

MODULE 4 **8 Hrs**

Biotechnological approach in plant disease management - tissue culture - somaclonal variation, transgenic plants etc.

MODULE 5 **8 Hrs**

Integrated plant disease management (IDM) - Concepts, advantages and Importance.

Text books:

1. Agrios, G.N. 2003...*Plant Pathology* Academy Press. New York.
2. Mehrotra,R.S. 1980. *Plant Pathology* Tata Mc. Graw Till Publ.Co., New Delhi.
3. Nene,Y.L. and Thapliyal,P.N. 1998.*Fungicides in Plant Disease Control*. Oxford and IBH New Delhi
4. Prakasam,V. Reguchander,T. and Prabakar,K. 1998.*Plant diseases management*. A.E. Publication, Coimbatore.

5. Singh.R.S 2002.*Introduction to Principles of Plant Pathology*. Oxford and IBH Publishing, New Delhi.
6. Sharma, P. D. 2001. Plant Pathology, Rastogi publications, shivaji Road, Meerut.

SAG3S1P-Fundamentals of Plant Pathology –Practical

Credit: 2

36 Hrs

Objectives

- To familiarize with the symptomatology of plant diseases.
- To develop skill in preparing and using plant protection chemicals and usage of plant protection equipments.

2 Hrs each for every practical

1. Common symptoms of plant diseases caused by fungi.
2. Symptomatology of viral diseases
3. Symptomatology of bacterial & phytoplasmal diseases.
4. Estimation of losses due to diseases
5. Method of scoring for diseases and Scoring for important fungal/Viral/bacterial diseases
6. Mass multiplication of important plant pathogens on cheap substrates and application on soil/plant –
7. Common laboratory techniques in mycology, preservation of plant disease specimens.
8. Microscopic slide culture, common media and mountants used in mycology.
9. Familiarization with different groups of fungicides.
10. Preparation of Bordeaux mixture, Bordeaux paste and cheshunt compound
phytotoxicity of fungicides
11. Preparation of fungicidal spray solutions- methods of application of fungicides -
spraying and soil drenching.
12. Seed treatment with systemic and contact fungicides.
13. Root feeding, post harvest treatment.
14. Solarisation for management of soil borne pathogens.
15. Demonstration of physical methods for crop disease management
16. Preparation and application of botanicals
17. Familiarization with plant protection equipments.
18. Field visits, survey and collection of disease samples

Note:- 1. Record in proper form should be maintained for the practical. Exercise should be completed in the practical class itself and should be approved by the course teacher on the same day. Each student should submit at the time of final examination a herbarium consisting of **50 (fifty)** well preserved specimen in three installments during the semester.

SAG3S2T-Protected cultivation of Horticultural crops

Credits: 3

54 Hrs

Objectives

- To familiarize with protected cultivation structures and cultivation practices

Module 1

12 Hrs

Introduction - scope and importance - problems and prospects of protected culture in India - growing structures - green house - polyhouse - net house - basic considerations in establishment and operation of greenhouses - maintenance .

Module 2

10 Hrs

Advantages of growing plants in a greenhouse - functioning and maintenance. Manipulation of environmental factors - environmental control systems in green house. Maintenance of cooling and heating system in green houses.

Module 3

10 Hrs

Type of containers used in protected culture. Substrate -Use of substrate and preparation of substrate for protected cultivation, soil decontamination. Water management - nutrient management (fertigation).

Module 4

12 Hrs

Crop regulation - special horticultural practices in protected cultivation for commercially important crops: vegetable crops, flowering plants, seedlings, etc

Module 5

10 Hrs

Harvesting methods - postharvest handling - standards - grading - packing and marketing.

Suggested Readings:

1. Foja Singh., 1997. Advances in Floriculture. Media Today Pvt. Ltd., New Delhi-17.
2. Prasad, S. and U.Kumar. 1998. Commercial floriculture. Agro Botanica. Bikaner - 334 004.
3. Roy. A. Larson., 1992. Introduction of Floriculture. International Book Distributing Co., Lucknow.
4. Vishnu Swarup., 1997. Ornamental Horticulture. Macmillan India Ltd., New Delhi-2. Wltez,

- S., 1972. The world gladiolus, NAGG, USA.
5. Yadav, L.P. and Bose, T.K., 1986. Biology, conservation and culture of orchids. East- West Press Private Limited, New Delhi.E.
 6. Yadav.I.S. and M.L. Choudhary., 1997. Progressive floriculture. The House of Sarpan, (Media), Bangalore.

SAG3S2P-Protected cultivation of Horticultural crops-Practical

Credit: 3

54 Hrs

- To practice with protected cultivation practices of important crops

Practical Schedule

1.	Study of structures utilized for protected culture.	6 Hrs
2.	Cost estimation of different growing structures	3 Hrs
3.	Design and orientation of poly/green houses.	4Hrs
4.	Study of various inputs used for protected culture	4 Hrs
5.	Type of containers used in protected culture.	3Hrs
6.	Use of substrate and preparation of substrate for protected cultivation	5Hrs
7.	Fertigation system in green houses	4 Hrs
8.	Maintenance of cooling and heating system in green houses.	5 Hrs
9.	Special horticultural practices in protected cultivation	6 Hrs

Protected cultivation aspects of individual crops: (2 Hrs each)

10. Protected cultivation of cowpea,
11. Protected cultivation of capsicum
12. Protected cultivation of cucumber
13. Protected cultivation of tomato
14. Protected cultivation of orchids and anthurium.
15. Protected cultivation of rose.
16. Protected cultivation of chrysanthemum.

SAG3S3T-Integrated Pest management in crops

Credits: 3

54 Hrs

Module 1

8 Hrs

IPM- introduction, importance, concepts, principles. Tools of IPM- Host plant resistance, definition, mechanisms of resistance, compatibility with other pest management practices - merits and demerits.

Module 2

12 Hrs

IPM Methods- Cultural methods, Mechanical methods, Physical and Legislative methods, Biological methods- definition, methods, advantages, limitations. Natural enemies- parasites, predators and microorganisms used in pest control.

Module 3

10 Hrs

Important groups of micro organisms-bacteria, viruses and fungi used in insect pest control. Mass multiplication techniques of important biocontrol agents.

Module 4

12 Hrs

Chemical control - importance, hazards and limitations. Classification of insecticides based on chemical nature- insecticides of plant origin (botanical insecticides) and Synthetic insecticides. Preparation of neem oil garlic emulsion and tobacco decoction. Formulations of insecticides and calculation of quantity of formulations for field application. Synthetic insecticides -organophosphates, carbamates, synthetic pyrethroids. Plant protection equipments - Classification- and working principles- parts of sprayers, dusters and uses.

Module 5

12 Hrs

Distribution, host-range, symptoms of damage and management practices for major pests of the following crops-Rice, Coconut, Banana, Cashew, Pepper, cardamom, Brinjal, Bittergourd and cowpea.

Text books:

1. Mani, M. S. 1968. General Entomology. Oxford and IBH Publishing Company, New Delhi.
2. Nayar, K. K., Ananthakrishnan T. N. and David.B.V. 1976. General and Applied Entomology, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Pedigo, L. P. 1999. Entomology and Pest Management. Third Edition. Prentice Hall, New Jersey, USA.
4. Richards, O.W. and Davies, R. G. 1977. Imm's General Text Book of Entomology, Vol.1&2, Chapman and Hall Publication, London..

5. Srivastava, P. D. and Singh, R. P. 1997. An Introduction to Entomology, Concept Publishing Company, New Delhi.
6. Dhaliwal, G. S. and Ramesh Arora. 1998. Principles of Insect Pest Management .Kalyani Publishers, New Delhi.

SAG3S3P-Integrated Pest management in crops-Practical

Credit: 1 **18 Hrs**

- | | |
|--|--------------|
| 1. Familiarization with cultural methods of pest control. | 1 Hr |
| 2. Familiarization with Mechanical methods of pest control. | 2 Hrs |
| 3. Identification of predators. | 1 Hr |
| 4. Identification of microbial agents. | 1 Hr |
| 5. Familiarization with different formulations of insecticides. | 1 Hr |
| 6. Preparation of neem oil garlic emulsion and tobacco decoction. | 1 Hr |
| 7. Familiarization with different insecticides. | 1 Hr |
| 8. Calculation of doses/concentrations of insecticides. | 2 Hrs |
| 9. Preparation of spray fluid for field application. | 2 Hrs |
| 10. Familiarization with Plant protection equipments. | 2 Hrs |
| 11. Identification, symptoms of damage, collection and preservation of pests of: | 4 Hrs |
| a) Rice, Coconut. | |
| b) Banana, Cashew. | |
| c) Pepper, cardamom. | |
| d) Brinjal, Bittergourd and cowpea. | |

SAG3S4T-Plant Physiology

Credit: 2 **36 Hrs**

Objectives:

- To familiarise with the physiological processes in plants.
- To learn about plant nutrients and use of growth regulators.

MODULE 1 **6 Hrs**

Crop Physiology, Introduction, and importance in agriculture. Growth and development- definition, determinate and indeterminate growth, Measurement of growth, growth analysis

growth characteristics, definitions and mathematical formulae.

MODULE 2

6 Hrs

Plant water relations: Crop water relations, physiological importance of water to plants, water potential and its components, measurement of water status in plants. Transpiration, significance, transpiration in relation to crop productivity, water use efficiency, WUE in C₃, C₄ and CAM plants. Factors effecting WUE.

MODULE 3

6 Hrs

Photosynthesis and respiration: Photosynthesis, Energy synthesis, relationship of photosynthesis and crop productivity, photorespiration; Factors affecting photosynthesis and productivity, methods of measuring photosynthesis, photosynthetic efficiency. Harvest index of crops, respiration and its significance.

MODULE 4

10 Hrs

Plant Nutrients, definition - classification of plant nutrients based on quantity, function and mobility - physiology of nutrient uptake - functions of plant nutrients - deficiency and toxicity symptoms of plant nutrients - foliar nutrition - hydroponics.

MODULE 5

8 Hrs

Plant growth Regulators: Plant growth regulators - occurrence - mode of action of auxins, gibberellins, cytokinins, ABA, Ethylene. Novel plant growth regulators, commercial application of plant growth regulators in agriculture (with examples in mango, pineapple, cucurbits, ornamental plants, pepper, rubber). Senescence - physiological and biochemical changes and their significance.

Text books:

1. Devlin R.M. 1979. Plant Physiology II Edn. Affiliated East West Press, New Delhi.
2. Noggle G.R. & Fritz G.J. 1992. Introductory Plant Physiology II Edn. Prentice Hall of India (P) Ltd., New Delhi
3. Bidwil R.G.S. Plant Physiology II Edn. Macmillan, Publishing Co., Inc. New York.
4. Salisbury, F. B. & Ross. C.W. Plant Physiology, CBS Publishers & Distributors, New Delhi
5. Milthrope, F.L. and Marby, J. 1979. An introduction to Crop Physiology, Cambridge University Press, London
6. Devlin R. M. and Witham F. H. 1983. Plant Physiology 4th Edn. CBS Publishers and Distributors, New Delhi.

7. Gupta .N.K and Sunita Gupta.2002.Plant Physiology.Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
8. Malick, C.P and Srivastava, A. K.2000. Text book of Plant Physiology. Kalyani publishers, New Delhi.

SAG3S4P- Plant Physiology

Credit: 1

18 Hrs

Objectives:

- To practise with the estimation of physiological parameters in plants
(1-7: 2 Hrs each and 8:- 4 Hrs)
1. Growth analysis; calculation of growth parameters, Yield analysis.
 2. Measurement of leaf area by different methods.
 3. Measurement of water status in plant parts.
 4. Measuring light intensity in canopies.
 5. Stomata; structure; frequency and index.
 6. Identification of plant nutrient deficiency symptoms.
 7. Detection of NPK deficiencies in plant samples by rapid tissue testing.
 8. PGRs - quantification and its effect on plant growth-auxins, GA.

SAG3GI1

Cultivation of rice

Credit: 5

Objectives

- To understand the sustainable cultivation aspects of rice under low land condition
Rice-crop planning, Nursery raising: Land preparation, seed treatment, sowing, water management, nutrient management, and plant protection Main field preparation, transplanting, nutrient management, water management, Identification of weeds and weed management, Identification of insect pests and diseases and plant protection, harvesting, postharvest handling of produce, storage and marketing of produce. Harvest Index- Preparation of balance sheet including cost: benefit ratio (A minimum 5cents will be allotted to each student).

Note: In addition to regular practicals, the students will complete certain time bound operations after the regular class hours.

SEMESTER- 4

SAG4S1T- Weed Management and Fodder crop production

Credit: 4

72 Hrs

Objectives

- To understand the general characters of weeds and their management
- To acquaint with cultivation of rice, fibre crops, fodder crops, etc.

MODULE 1

18 Hrs

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination. Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management (IWM); Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application. Compatibility of herbicides with other agro chemicals; Weed management in rice, banana, pineapple, coconut, rubber, vegetables. Aquatic and problematic weeds and their control.

MODULE 2

13 Hrs

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, harvesting and postharvest handling of major Oilseeds, Sugar cane, Fibre crop, Narcotics, Medicinal plants.

MODULE 3

13 Hrs

Crop Production in rice in detail: Methods of sowing, Varieties and their duration, various systems of rice cultivation. Raising of nursery, sowing in the main field, Nutrient and water management. Weed Management in rice. Harvest indices in rice.

MODULE 4

12 Hrs

Mechanised farming in Rice. Introduction to various machines employed in mechanised rice cultivation including field preparation, weeding and harvesting.

MODULE 5

16 Hrs

Agrostology - Important terms and definitions - Importance in live stock nutrition - classification of fodder crops, economic importance, soil and climatic requirements, varieties, cultural practices, harvesting and yield (Guinea grass, Hybrid Napier, Congo signal, Gambagrass, Setaria, Cerealfodders, Groundlegumes, Treelegumes, Pastures) and Forage preservation.

Text books:

1. Agarwal, P.C. 1990.Oilseeds in India. Oxford and IBH, New Delhi
2. Balasuramaniyan, P. and Palaniappan, SP. 2003.Principles and Practices of Agronomy.Agrobios(India)
3. Barnes, A.C. 1964.The Sugarcane.Interscience Publishers, New Delhi
4. ChiddaSnidngh, Prem Singh and Rajbir Singh.2003. Modern Techniques of Raising Field Crops (2 Ed.). Oxford &IBH, New Delhi.
5. ICAR [Indian Council of Agricultural Research].2006. Hand Book of Agriculture. ICAR, New Delhi
6. KAU [Kerala Agricultural University].2007.Package of Practices Recommendations - Crops. Directorate of Extension, Kerala Agricultural University, Thrissur
7. Lekshmikantan, M. 1983.Technology in Sugarcane Growing. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi
8. Prasad, R. (Ed.). 2001. Field Crop Production. ICAR, New Delhi
9. Purseglove, J.W. 1975. Tropical Crops: Monocotyledons. The English Language Book Society and Longman, London
10. Thomas, J., Joy, P.P., Mathew, S., Skaria, B.P., Duethi, P.P. and Joseph, T.S. 2000.Agronomic Practices for Aromatic and Medicinal Plants.Directorate of Arecanut and Spices Development, Kozhikode.
11. Yadav, D.S. 1992. Pulse Crops. Kalyani Publishers., New Delhi.
12. Gurmel Singh, C. Venkataraman, G., Sastry,B. and Joshi, P. 1990.Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co., New Delhi.
13. IARI [Indian Agricultural Research Institute]. 1977. Water Requirement and Irrigation
14. Management of Crops in India, IARI Monograph No.4, Water Technology Centre, IARI, New-Delhi.
15. Lenka, D. 2001.Irrigation and Drainage.Kalyani Publishers, New-Delhi.
16. Mal, B. C.2002. Introduction to Soil and Water Conservation Engineering,Kalyani
17. Michael, A.M. 1988.Irrigation Theory and Practice.Vikas Publishing House Pvt. Ltd., New Delhi.
18. Mishra, R.D. and Ahamed, M. 1993.Manual of Irrigation Agronomy.Oxford and IBH Publishing Company Pvt. Ltd.
19. Prihar, S.S. and Sandhu, B.S. 1987. Irrigation of Field crops - Principles and Practices - ICAR, New-Delhi.

20. SankaraReddi, G.H. and Yellamanda Reddy, T.2003 Efficient Use of Irrigation Water. Kalyani Publishing House, New Delhi.
21. Tideman, E.M. 1996. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi.
22. Aldrich, R.J. and Kramer, R.J. 1997.Principles in Weed Management.Panama Publications, New Delhi.
23. Anderson, P.W. 1983. Weed Science - Principles. West Publishing Con.d New York
24. Ashton, P.M. and Crafts, A.S. 1981. Mode of Action of Herbicides (2 Ed.) Wiley- Inter Science, New York.

SAG4S1P-Weed Management and Fodder crop production-Practical

Credit:

36 Hrs

Objectives

- To familiarize with the general characters of weeds and their management.
- To familiarize with cultivation of rice, fibre crops, fodder crops etc.

(3 Hrs each)

1. Techniques of weed collection, identification and preparation of herbarium of weeds.
2. Herbicide formulation and identification- Herbicide label information.
3. Study of herbicide application equipments and calibration.
4. Computation of herbicide doses.
5. Field practice of spraying herbicides in the field.
6. Recording observations on the effect of herbicides on crops and weeds.
7. Hand weeding and hoeing using conoweeder in rice.
8. Hoeing and after cultivation in cassava plots.
9. Economics of weed control practices.
10. Visit to areas with problem weeds.
11. Familiarization and planting of various fodder crops and their preservation.
12. After cultivation operations of major crops.

SAG4S2T- Livestock Farming

Credit: 3

54 Hrs

Objectives

- To familiarize with fundamentals of livestock farming.
- To acquaint with the management of various farms.

MODULE 1

10 Hrs

Role of Livestock in National economy: Management- Principles of management, Functions of management, Tools of management. General Management Practices in Dairy farming- Grooming, Drying off, Control of bad habits, Castration, Dehorning, Trimming, Shoeing, Identification marks, removing extra teats.

MODULE 2

12 Hrs

Cattle and Buffalo management- Housing of Cattle, Calf raising, Heifer management, Management of pregnant and lactating cow and Buffaloes, Care and management of cross breed cow, Care and management of breeding bull, Sheep and Goat management- Housing of sheep and goat, General management practices.

MODULE 3

6 Hrs

Milk Industry: Dairy Development in India- Operation Flood Programme, Contribution of Military Dairy Farm, NDDB, NDRI, Milk grid to dairy development. Dairy Co-operatives structure and functions, Milk Chemistry and Milk constituents- Definition of Milk, Composition of Milk, Constituent of Milk, Factors affecting Quality and Quantity of milk, Nutritive value of milk, Physico-chemical properties of milk. Clean milk production: Source of contamination.

MODULE 4

11 Hrs

Poultry management: - Housing of Poultry, General Management practices, Pig Farming, Rabbit Farming, Duck Farming- Breeds of duck, General management practices. Quail management.

MODULE5

15 Hrs

Classification of Animal Diseases: Study of major Diseases- Foot and mouth disease (FMD) Rinderpest, Anthrax, Black quarter (BQ), Haemorrhagic Septicaemia (HS). Study of Parasitic Diseases: Brucellosis, Babesiosis, Theileriosis. Diseases of lactating cow: Mastitis, Dystokia Milk fever, Prolaps, Ketosis. Diseases of Calves: Pneumonia, Calf score, Diarrhoea. Poultry Diseases- Ranikhet, Coccidiosis, Bird flu, Parasites of poultry. First aid measures. Disposal

of carcasses.

Text books:

- 1) A Text Book of Animal Husbandry by G.C. Banarjee
- 2) A Text Book of Animal Science by. Dr. A.U. Bhikane and Dr. S.B. Kawitkar
- 3) Advances in Dairy Animal Production by V.D. Mudgal, K.K. Singhal and D.D. Sharma
- 4) Handbook of animal Husbandry, The I.C.A.R. publication
- 5) Animal Husbandry & Dairy Science by. Jagdish Prasad.
- 6) Dairy India Yearbook - 2007 by. P.R. Gupta
- 7) Hanbook of Veterinary Physician by V.A. Sapre
- 8) Farm Animal management and feeding practices in India by Thomas & Shashtri
- 9) Dairy Microbiology by K.C. Mahanta

SAG4S2P- Livestock Farming-Practical

Credit: 2

36 Hrs.

Objectives

- To familiarize with practices in livestock farming.
- To acquaint with the management of important farm animals and birds

- | | |
|---|-------------|
| 1. Morphology of cattle, buffalo and poultry | 3hrs |
| 2. Classification of Cattle Breeds | 1hr |
| 3. Study of Cattle, Breeds | 3hrs |
| a. Milch : Gir, Sahiwal, Red Sindhi, | |
| b. Draught: Khillar, Dangi, Red kandhari. | |
| c. Dual: Deoni, Hariyana | |
| d. Exotic: Jearsy, H.F. | |
| e. Cross breed: Holdeo, Jerdeo. | |
| 4. Study of Buffalo Breeds: Murrah, Jaffrabadi, Nagpuri and Surti | 3hrs |
| 5. Study of Sheep and Goat breeds: Osmanabadi, Jamnapuri, Saanem | 3hrs |

6. Study of Duck breeds: Chara Chemballi, Khaki, Campbell, Vigova	2hrs
7. Identification marks of farm animals	1hr
8. Handling and casting of farm animals	1hr
9. Study of milking dairy animals	2hrs
10. Determination of age of animal	1hr
11. Determination of body weight of animal	1hr
12. Recording temperature, pulse and respiration rate of farm animals	2hrs
13. Preparation of antiseptic ointment	1hr
14. Preparation of vaccination schedule	1hr
15. Study of dairy farm records	2hrs
16. Visit to veterinary hospital	3hrs
17. Visit to Dairy farm/ Poultry farm/Goat farm/Duck Farm	6hrs

SAG4S3T-Farm Power and Machinery

Credit: 3 **54 Hrs**

Objectives

- To acquaint with principles of farm machineries and their working.

MODULE 1 **4 Hrs**

Status of farm power in India and Kerala- sources of farm power - merits and demerits of different forms of power.Farm mechanization-scope of farm mechanization- present status of mechanization-limiting factors and suggestions of farm mechanization.

MODULE 2 **10 Hrs**

Thermodynamic cycle. Principle of working of internal combustion engines. Terminology connected with engine power. Fuel system, lubrication system and cooling system of IC engines.

MODULE 3 **10 Hrs**

Farm tractor -classification-components and selection.Power transmission system of a tractor- clutch-governor-differential.Hydraulic control system of tractor.Tractor testing-performance characteristics of tractor engines. Power tiller-components of power tiller. Principles of operation of electric motor-types-components-care and maintenance.

MODULE 4**15 Hrs**

Tillage. Plough-classification-types-components-adjustments and repairs of mould board plough and disc plough. Plough accessories like coulter, jointer, scraper, land wheel and gauge wheels. Terminology connected with ploughs-advantages and disadvantages of different ploughs.

MODULE 5**15 Hrs**

Ploughs like chisel plough, subsoiler and rotary plough etc. Harrows,Cultivators, Puddlers, Bund former, Ridger etc.Seed drill and seed cum fertilizer drill- components-types-calibration.Planter-functions-components. Plant protection equipments-sprayer-types-components-care and maintenance .Harvesters.

Text books:

1. Chakraverty, A. and D.S.De. 1981. *Post-harvest technology of cereals and pulses*. Oxford and IBH Publishing Co., Calcutta.
2. Mohsenin, N.N. 1970. *Physical properties of plant and animal materials*, Gordon and Breach publishers, New York.
3. Pande, P.H.1994. *Principles of agricultural processing*, Kalyani Publishers, Ludhiana.
4. Sahay, K.M. and K.K. Singh. 1994. *Unit operations in agricultural Processing*, VikasPublishing House Pvt. Ltd., New Delhi.

SAG4S3P- Farm Power and Machinery-Practical**Credits: 2****36 Hrs**

- To acquaint with principles of farm machineries and their working

(3Hrs each)

1. Study of tools and equipments in a farm machinery workshop.
2. Study of different components of an IC engine.
3. Study of different components, operation and maintenance of power tiller.
4. Study of farm / homestead friendly equipment and implements.
5. Study of different components and operation of tractor.
6. Study of Mould Board plough and disc plough and its adjustments.
7. Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; adjustments.
8. Study of cultivators and harrows and its adjustment.
9. Study of different parts, registration, alignment and operation of mowers and its adjustments.
10. Study of paddy transplanter and harvester, registration and alignment.

11. Study of planters and different metering mechanisms.
12. Study of sprayers, repair and its calibration.

Text books:

1. Chakraverty, A. and D.S.De. 1981. *Post-harvest technology of cereals and pulses*. Oxford and IBH Publishing Co., Calcutta.
2. Mohsenin, N.N. 1970. *Physical properties of plant and animal materials*, Gordon and Breach publishers, New York.
3. Pande, P.H.1994. *Principles of agricultural processing*, Kalyani Publishers, Ludhiana.
4. Sahay, K.M. and K.K. Singh. 1994. *Unit operations in agricultural Processing*, VikasPublishing House Pvt. Ltd., New Delhi.

SAG4S4T- Commercial vegetable production

Credit: 2	36 Hrs
Module 1	5 Hrs
Introduction - Importance and scope of vegetable crops of India with special emphasis to Kerala. Nutritional importance- nutrient value of vegetables, ANV. Classification of vegetables - types of classification and their bases - Botanical, cultural, thermo classification, classification based on parts used.	
Module 2	6 Hrs
Factors affecting vegetable production- soil, temperature, light, water, nutrients. Basic principles of vegetable production. Nursery, sowing and transplanting, Care and management.	
Module 3	9 Hrs
Types of vegetable farming - Kitchen garden; Market garden; Truck garden; vegetable forcing; Vegetable garden for seed production; Hydroponics, aeroponics, Riverbed system, Terrace Garden etc. Kitchen garden- site selection, principles of layout, cropping schedule. Growth regulators -role of growth regulators in vegetable production and methods of application.	
Module 4	10 Hrs
Production technology of warm season vegetable- Importance, origin, taxonomy, varieties, cultivation, problems and prospects for Solanaceous crops- tomato, brinjal and chilli- Cucurbits- bitter gourd, snake gourd, cucumber, melons, pumpkins, watermelon and ivy gourd. Leguminous crops- vegetable cow pea and winged bean. Other vegetables-okra, amaranthus.	
Module 5	6 Hrs
Production Technology of cool season vegetables- Importance, origin, taxonomy, Varieties,	

cultivation, problems and prospects of potato, cole crops- cabbage & cauliflower. Root crops- carrot, radish, beetroot. Bulb crops- onion, garlic and Leafy vegetables.

SAG4S4P - Commercial vegetable Production - Practical

Credit: 1

18 Hrs

(2 Hrs each)

1. Familiarization of different vegetable crops- through field visits and slide show.
2. Main field preparation and planting of transplanted tropical vegetable crops.
3. Main field preparation and planting of direct sown vegetable crops.
4. Preparation of nursery bed, sowing and aftercare of seeds of vegetable crops.
5. Preparation of growth regulator solutions and application.
6. Maturity indices and harvesting of vegetables for vegetable purpose and seed purpose.
7. Identification and familiarization of cool season vegetables.
8. Main field preparation and planting of cool season vegetables.
9. Visit to the farmer's fields in the vegetable growing areas to study the field problems faced by the farmer.

SAG4GI1

Agricultural Engineering- Farm Machinery

Credits: 5

Objectives

- To acquaint with use of farm machineries in field.

Main field preparation, transplanting, nutrient management, weed management, and plant protection aspects by allotting each student 5 cent land for setting up of a Kitchen garden purely in mechanized ways: use of tractors and tillers, cultivators and harrows, seed drill, sprayers etc.

Note: In addition to practical hours, the students will complete certain time bound operations after the regular class hours.

- To develop skill in setting up of a mechanised Kitchen Garden; Main field preparation, transplanting, nutrient management, water management, and plant protection aspects by allotting each student 5 cent land for setting up of a Kitchen garden

Note: In addition to practical hours, the students will complete certain time bound operations after the regular class hours.

SEMESTER - 5

SAG5S1T- Landscape designing and indoor gardening

Credit: 2

36 Hrs

Objectives

- To get awareness on designing and laying out of a landscape.
- To familiarise with different types and features of garden.

MODULE 1

7 Hrs

Designing of landscape: Principle of landscape design. Selection and use of plants in the landscape. Preparation of landscape plan. Various soft wares used in garden designing. Digitalization in designing. Computer aided landscape designing - GIS.

MODULE 2

7 Hrs

Maintenance of plants in landscape: Planting and maintenance of plants in the landscape. Methods of irrigation - sprinkler and drip irrigation-pot irrigation, wick irrigation etc. Methods of application of fertilizers to garden plants.

MODULE 3

7 Hrs

Garden tools: Use of tools and implements. Use of different types of sprayers, lawn mowers, hedge cutters, tree cutters, leveling methods.

MODULE 4

7 Hrs

Garden structures and garden types: Garden structures, roads and paths, enclosures, paving, garden lights, furniture. Different types of garden and features. Establishment and maintenance of lawn.

MODULE 5

8 Hrs

Indoor gardening: Selection of indoor plants. Layout and designs of indoor gardens - types of containers used, media composition, preparation of media, planting and placement of plants. Models for interior plant scaping - vertical garden, miniature garden and terrariums. Manuring, irrigation, illumination, grooming and holiday care of indoor plants.

Text books:

1. Edmond, JB., Sen, TD, Andrews, TS and Halfacre, RG. 1977. *Fundamentals of Horticulture*. Tata McGraw Hill, New Delhi.
2. Janick, J. 1963. *Horticultural Science*. W.H. Freeman, Sanfrancisco.
3. Kumar, N. 1990. *Introduction to Horticulture*, Rajalekshmi Publication, Nagercoil.

4. Carpenter, P.L., Walker, T.D and Lanphear, F.O. 1975.*Plants in the Landscape*.W.H. Feeman and Co., San Francisco.
5. Desai, B.L. 1979. *Planning and Planting of Home Gardens*. Indian Council of Agricultural Research, New Delhi.
6. Joiner, J.N. 1981.*Foliage Plant Production*. Prentice Hall Inc. London.
7. Nambisan, K.M.P. 1991. *Design elements of landscape gardening*. Oxford & IBH Publishers Pvt. Ltd Calcutta.
8. Swarup, V. 1993.*Indoor Gardening*. ICAR, New Delhi.
9. Trivedi, P.P. 1983.*Home Gardening*. Indian Council of Agricultural research, New Delhi.

SAG5S1P - Landscape designing and indoor gardening - Practical

Credit: 2

36 Hrs

Objectives

- To develop skill in planning and planting of garden lawn.
- To develop skill in preparation of different types of gardens.

(3 Hrs each)

1. Preparation of landscape plan, identification of plants.
2. Use of software in landscape designing, computer aided landscape designs.
3. Planting of lawn.
4. Rolling and mowing of lawn - use of different types of lawn mowers.
5. Planting of trees and shrubs, preparation of flower beds.Pruning of shrubs, hedges and trees.
6. Application of manures and fertilizers to garden plants. Practice in different methods of irrigation in landscapes.
7. Practice in application of plant protection chemicals, use of different types of sprayers.
8. Selection and establishment of enclosures and paving.
9. Layout of roads, paths and walks.
10. Preparation of rock garden.
11. Designing indoor garden.
12. Preparation of miniature garden and vertical garden. Preparation of terrarium.

SAG5S2T-Commercial Enterprises

Credit: 3

54 Hrs

Objectives

- To understand various commercial enterprises in agricultural sector through observation, field visits and presentation.

MODULE 1

12 Hrs

Beekeeping -history and development. Honey bees- kinds of bees, biology-Hiving and domestication. Seasonal management of bees.Bee pasturage. Bee products- extraction, uses, composition and preservation. Diseases and enemies of honey bees and their control. Bee poisoning. Scope of apiculture in Kerala. Recent advances in apiculture research.

MODULE 2

10 Hrs

Sericulture - history and development. Types of silkworms in India - morphology, biology, rearing of silkworms.Host plants and their cultivation.Diseases and enemies of silkworm and their control. Use of biotechnology in sericulture.Scope of sericulture in Kerala. Recent advances in sericulture research.

MODULE 3

6 Hrs

Lac culture -behavior and development of lac insects.Different strains and their host plants.Inoculation, harvesting and processing of lac.Lac and its uses.Enemies of lac insect and their control.Scope for cultivating lac in Kerala. Recent advances in lac culture research.

MODULE 4

16 Hrs

Mushroom cultivation, Importance of mushroom cultivation - definition of mushroom - its importance - present scenario of mushroom cultivation - general morphological features, taxonomy and identification of different mushrooms-poisonous, hallucinogenic and medicinal Mushrooms. Pure culture of mushrooms and their nutritional requirements. Definition of spawn, substrate for spawn, types of spawn, methods of spawn production, characteristic of a good spawn, storage of spawn. Cultivation of Agaricus species - composting - its formulation, casing, preparation of casing mixture, sterilization, cultivation of pleurotus, Volvariella, Lentinus, Calocybe and Auricularia. Different types of substrates, substrate preparation and sterilization, Spawning, methods of spawning, spawn run phase, cropping. Identification and management of different pests and diseases of mushrooms. Methods of harvesting mushrooms, post harvest treatments and preservation of mushrooms. Packing and processing - Different methods of processing, canning and dehydration. Nutritive value of mushrooms and preparation of different recipes.

MODULE 5

12 Hrs

Commercial floriculture, Status and prospects of commercial cultivation of flowers. Cultivation aspects of traditional and cut flowers - jasmine, crossandra, marigold, tuberose, gladiolous, heliconia etc. Protected cultivation of rose, gerbera, chrysanthemum etc. - general concepts and practices. Commercial cultivation of orchid's and anthurium. Status and prospects of Kerala. Classification and varieties, planting material production, methods of planting, media components and management, shade regulation, irrigation, nutrition, plant protection, stage and method of harvest, postharvest handling and marketing. Economics of cultivation.

Text books:

1. David, B. V. and Kumarawami, T. 1978. *Elements of Economic Entomology* Popular Book Depot, Madras.
2. Ganga, G. and Sulochanachetty. 1999. *An Introduction to Sericulture* Second edition. IBM and Oxford Publishing Company, New Delhi.
3. Groul, R.A. 1963. *The Hive and the Honeybee*. Dadani and Sons. Inc. Illinois.
4. Krishnaswami, S., Narasimhanna, Suryanarayana and Kumararaj. 1991. *FAO Manuals on Mulberry Cultivation, silkworm rearing and silk reeling*. IBM and Oxford Publishing Company, New Delhi.
5. Mishra, R. C. 1998. *Perspectives in Indian Apiculture*. Agro botanica, Bikaner, Rajasthan
6. Sardar Singh. 1962. *Bee Keeping in India*. ICAR, New Delhi.
7. Chang, S. T. Miles, P. G. and Hays, W. A. 1978. *The Biology and Cultivation of Edible Mushrooms*. Academic Press, London.
8. Lulu Das. 2002. *Mushroom Recipes*. (Released in the VIII Biennial meeting of AICMIP).
9. Nair, M. C. 1995. *Beneficial Fungi and Their Utilization*. Scientific publishers, New PaliRoad, Jodhpur.
10. Randhawa, G.S. and Mukhopadhyay, A. 1986. *Floriculture in India*. Allied publishers New Delhi.
11. Rogers, J. 1974. *Flower arranging*. Hamlyn, London.

SAG5S2P - Commercial Enterprises- Practical

Credits: 2

36 Hrs

Objectives

- To develop awareness on bee keeping, sericulture and lac culture through observation, field

visit and reporting.

- To develop skill in cultivation of edible mushrooms and to develop skill in dry flower production and bouquet making.

(2 Hrs each)

1. Different types of bees and bee equipments.
2. Handling of bee colonies.
3. Extraction and processing of honey.
4. Visit to apiaries.
5. Identification of silkworms
6. Laboratory rearing of mulberry silkworms and visit to rearing units.
7. Identification of lac insects and their natural enemies.
8. Identification of common edible and poisonous mushrooms.
9. Preparation of substrates for mushroom cultivation.
10. Oyster mushroom cultivation.
11. Paddy straw mushroom cultivation.
12. Button mushroom cultivation.
13. Visit to a commercial mushroom production unit.
14. Methods of harvesting mushrooms.
15. Mushroom recipes – preparation.
16. Production techniques of dry flowers.
17. Value addition in cut flowers and loose flowers, hands on training in preparation of garlands, bouquet, flower arrangements etc.
18. Visit to commercial production units of orchids, anthurium and other cut flowers.

SAG5S3T-Fundamentals of organic farming

Credits: 2

36 Hrs

Objectives

- To familiarize with the concept of sustainability and sustainable development.
- To acquaint with the fundamentals of organic farming.
- To have the knowledge about the organic certification procedures.

MODULE 1**7 Hrs**

The concept of sustainability and sustainable development-emerging issues- Sustainable agriculture- concept themes- differences between conventional, sustainable, and alternate agriculture- Various alternate agricultural systems- Conventional, sustainable, and alternate agriculture- Alternate agricultural systems- biodynamic farming, natural farming, organic farming, permaculture, homa farming, and other formslimitations- Modernization of agriculture and its relation to sustainability.

MODULE 2**7 Hrs**

Factors affecting ecological balance and ameliorative measures- Indian agriculture in terms of availability of natural resources and their carrying capacity- Strategies for realizing sustainable agriculture- low vs. high external input agriculture -Natural resource management as a part of sustainable resource management -crop production practices- animal production practices- Basic ecological principles of LEISA - promising LEISA techniques and practices –Good Agricultural Practices(GAP)- GAP certification -Improved manure handling - crop residue management - strategic use of chemical fertilizers and pesticides, traps, repellants and biological control, water conservation measures for sustainability- water harvesting - ITK and farmer centered techniques and practices.

MODULE 3**7 Hrs**

Organic agriculture-history-concepts- philosophy- objectives, opportunities and priorities- Criticisms- Organic farming and food security-Principles of organic farming. Tools and practices of organic farming: Planned crop rotation, Green manures and cover crops, Manuring and composting, multiple cropping.Intercropping in relation to maintenance of soil productivity.

MODULE 4**8 Hrs**

Biological pest control: Biological agents -Mass multiplication and familiarization with field application, Different traps and pheromones for pest control. Biocontrol of weeds, diseases and insect pests, Sanitation, Tillage and cultivation, Mulching, Supplemental fertilization, Biorational pesticides, Foliar fertilization.

MODULE 5**7 Hrs**

Socio-economic impacts; Marketing and export potential - Current status of organic farming - Initiatives in India and Kerala- National Programme for Organic Production (NPOP) - Operational structure of NPOP-Accreditation agencies- Certification Agencies - National Standards for Organic Products (NSOP)-inspection and certification procedures.

Text books:

1. Ananthkrishnan, T.N. (ed.) 1992. Emerging Trends in Biological Control of Phytophagous insects. Oxford & IBH, New Delhi.
2. Chhonkar, P.K. and Dwivedi, B.S. 2004. Organic farming and its implications on India's food security. Fertil. News 49(11): 15-18,21-28,31&38.
3. Gaur, A.C. 1982. A Manual of Rural Composting. FAO/UNDP Regional Project Document, FAO, Rome.
4. Howard, A. 1940. An Agricultural Testament. Oxford University, London. Lampin, N. 1990. Organic Farming. Farming Press Books, Ipswich, U.K.
5. Palaniappan, S.P and Anandurai, K. 1999. Organic Farming- Theory and Practice, Scientific Pub., Jodhpur.
6. Reddy, M.V. (ed.) 1995. Soil organism and Litter decomposition in the Tropics. Oxford & IBH, New Delhi.
7. Singh, S.P. (ed.) 1994. Technology for Production of Natural Enemies, Project Directorate of Biological Control, Bangalore.
8. Trewavas, A. 2004. A critical assessment of organic farming and food assertions with
9. Trivedi, R.N. 1993. A Text Book of Environmental Sciences, Anmol Pub., New Delhi.
10. Veeresh, G.K., Shivashankar, K. and Singlachar, M.A. 1997. Organic Farming and Sustainable Agriculture, Association for Promotion of Organic Farming, Bangalore.
11. Woome, PL. and Swift, M.J. 1994. The Biological Management of Tropical Soil Fertility, S.B.F. & Wiley.

SAG5S3P-Fundamentals of organic farming- Practical**Credits: 2****36 Hrs****Objectives:**

- To familiarize with the production and utilization of biofertilizers and biocontrol agents.

(3 Hrs each)

1. Preparation of enriched farm yard manure.
2. Coir pith composting.
3. Preparation of Vermicompost.
4. Study and field application of biofertilizers.
5. Raising green manure crops and cover crops.
6. Plant protection through bio-agents and traps.

7. Plant protection using pheromones.
8. Visit to urban waste recycling unit.
9. Study of profitable utilization of agricultural wastes.
10. Visit to poultry and dairy units to study resource allocation, utilization and economics.
11. Visit to an organic farm to study various components and utilization.
12. Raising of crops and ornamental nursery raising organically through nutrient, diseases and pest management.

Text books:

1. Ananthkrishnan, T.N. (ed.) 1992. *Emerging Trends in Biological Control of Phytophagous insects*. Oxford & IBH, New Delhi.
2. Chhonkar, P.K. and Dwivedi, B.S. 2004. Organic farming and its implications on India's food security. *Fertil. News* 49(11): 15-18,21-28,31&38.
3. Gaur, A.C. 1982. *A Manual of Rural Composting*. FAO/UNDP Regional Project Document, FAO, Rome.
4. Howard, A. 1940. *An Agricultural Testament*. Oxford University, London. Lampin, N. 1990. *Organic Farming*. Farming Press Books, Ipswich, U.K.
5. Palaniappan, S.P and Anandurai, K. 1999. *Organic Farming- Theory and Practice*, Scientific Pub., Jodhpur.
6. Reddy, M.V. (ed.) 1995. *Soil organism and Litter decomposition in the Tropics*. Oxford & IBH, New Delhi.
7. Singh, S.P. (ed.) 1994. *Technology for Production of Natural Enemies*, Project Directorate of Biological Control, Bangalore.
8. Trewavas, A. 2004. A critical assessment of organic farming and food assertions with
9. Trivedi, R.N. 1993. *A Text Book of Environmental Sciences*, Anmol Pub., New Delhi.
10. Veeresh, G.K., Shivashankar, K. and Singlachar, M.A. 1997. *Organic Farming and*
11. *Sustainable Agriculture*, Association for Promotion of Organic Farming, Bangalore.
12. Woomer, PL. and Swift, M.J. 1994. *The Biological Management of Tropical Soil Fertility*, S.B.F. & Wiley.

SAG5G1T- Principles of Agribusiness Management

Credits: 4

72 Hrs

Objectives

- To familiarise with the fundamentals of information and communication management.

- To understand entrepreneurship strategies.

MODULE 1

11 Hrs

Information and communication management, Fundamentals of information and communication- solving agricultural problems with information systems- a managerial overview of information and communication, Information- characteristics, Information Vs Knowledge, ABC nature of information, Information as a crucial resource, Different channels of information - communication- Radio, TV, Video, E-mail, Network connecting devices-intranet, internet, Photography, basics -its use in ICM, Digital Photography -its advantages, Agricultural Information System - Agricultural databases - Definition and objectives, Decision Support system, Expert system, Remote Sensing - Geographic data and maps, Geographical information system.

MODULE 2

15 Hrs

Management of agro based industries, Understanding entrepreneurship-need for EDP, entrepreneurial process, entrepreneurial traits and competence-dynamics of entrepreneurship. Agribusiness-concept, nature and scope of agri. Business-status-present role and future prospects, forms of agribusiness organizations-their advantages and disadvantages. Special economic zone-It's advantages and disadvantage. Preparing business plan-what is a business plan. Characteristics of a good business plan, elements of business plan, why some plans fail, licensing- government policies and sanction, certification and patent law. Agribusiness development, steps in setting up a small enterprise analysis of opportunities. Small business management, the process of management, organizing the enterprise.

MODULE 3

10 Hrs

Financial accounting and manpower management, Basic principles of financial accounting. Basic principles of financial management- book keeping, accounting records, People management- man power planning, recruitment and selection, orientation, training and development, creating a positive work environment, building up a team of advisors, networking for entrepreneurs, employment regulations.

MODULE 4

18 Hrs

Marketing management, Concept of marketing management - Marketing - new concept - business marketing - , holistic marketing - scope- marketing management process, Marketing mix - Market structure and Consumer buying behavior. Marketing environment- Responding to market environment. Marketing opportunities analysis - marketing management tasks, Marketing Planning Process. New product development process - Challenges in new product development, Organizational arrangements, managing the development process, consumer adoption process. Marketing segmentation, Product, Brand, Selection of Market and product, Source of Information, Global Sourcing, Marketing intelligence. Basic principles of international

trade, foreign exchange and export.

MODULE 5

18 Hrs

Agricultural Projects, Project concept- definitions- project approach to development, Agricultural projects. Characteristics- relationship of projects with plans and programmes. Phases of project cycle- identification- formulation, appraisal- implementation- monitoring and evaluation- Risk in agricultural projects- methods of handling risk projects. Preparation of a model agricultural project.

Text books:

1. Drilon, Dr.J.D, 1971, Introduction to Agri-Business Management (Asian Productivity Organization, Tokyo).
2. Developing Entrepreneurship, Asia pacific Theories and practices ASEED, New Delhi.
3. Alagumani ,T , Chinnaiyan, P and Elangovan, S . 1998. *Agricultural Management* .Publishers K9 International, Madurai
4. Reddy,S., Raghuram,P., Neelakantan,T.V and Bhavani Devi I.2004.*Agricultural Economics*. Oxford and IBH Publishers, New Delhi.
5. Reddy,Subba,S. and Raghu Ram.P. 1996. *Agricultural Finance and Management*. Oxford IBH, New Delhi.
6. Book Keeping and Accountancy.Choudhari, Chopde
7. Dahama.O.P. and O.P. Bhatnagar, 1980.Education and Communication for development, Oxford and IBH, New Delhi.
8. Fuller.R, 2000.Special Edition using MS Power point, McMillan Publishing Company, USA.
9. Boctor.B.S., 2000. MS Office 2000-Microsoft Press Release, USA.
10. Chandrakanthan.K and Palanichamy.S., 2002. Advances in Communication Technology, Indian publishers and distributor, New Delhi.

SAG5G2T- Tissue Culture

Credit: 3

54 Hrs

Objectives:

- To get practiced with various aspects of tissue culture.
- To learn applications of tissue culture in crop improvement.

Module 1	8 Hrs
Principles of Totipotency and Morphogenesis, Nutritional requirements of in-vitro cultures.	
Module 2	14 Hrs
Techniques of In-vitro cultures: Micro propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture; Applications and Achievements.	
Module 3	12 Hrs
Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids.	
Module 4	10 Hrs
Secondary plant metabolites-definition-their value as medicinal, aromatic and industrial materials-plant cell and tissue culture as an alternative source of secondary and natural products.	
Module 5	10 Hrs
Tissue culture as a tool in genetic engineering. Applications in crop improvement.	

Text books:

1. Chawla H S. 2003. Oxford & IBH Publishing Co. Pvt. Ltd. Chawla H. S. Introduction to Plant Biotechnology.
2. Brown, T.A. 1995. Gene cloning an Introduction (3rd edition). Chapman Hill, U.K.
3. Lehninger. 1993. Principles of Biochemistry. CBS Publications, New Delhi. Lewin, B. Genes VII. Oxford University Press, Inc., New York.
4. Watson, J.D., N.H. Hopkins, J.W. Roberts, J.A. Steits and A.M. Weiner. 1987. Molecular Biology of the Gene. The Benjamin/Cummings Publishing Co. Inc. Menlo Park
5. Singh, B.D. 1998. Biotechnology. Kalyani Publications, New Delhi
6. Bhojwani, S.S. and Razdan, M.K. 1993. Plant Tissue Culture. Theory and Practice. Elsevier Science Publications, Netherlands.

SAG5G2P-Tissue Culture-Practical

Credit: 2	36 Hrs
(4 Hrs for each)	
1. Requirements for Plant Tissue Culture Laboratory.	
2. Media components and preparations.	

3. Preparation and sterilization of media.
4. Aseptic manipulation and inoculation of various explants.
5. Callus induction, subculturing and plant regeneration.
6. Micro propagation of important crops.
7. Demonstration of Anther culture.
8. Demonstration of embryo culture.
9. Hardening/ acclimatization of regenerated plants.

SAG5G3T

Open course (Course offered by other departments in the college)

Credit: 3

54 Hrs

SAG5SI1

Organic farming

Credit: 5

Objectives

- To acquaint with organic cultivation of vegetables

Main field preparation, transplanting, nutrient management, water management, and plant protection aspects by allotting each student 5 cent land for setting up of a organically grown vegetable field in a sustainable way.

SEMESTER - 6

SAG6S1T-Agro Meteorology

Credit: 4

72 Hrs

Objectives:

- To study various meteorological aspects in relation with crop production

MODULE 1

14 Hrs

Introduction to Meteorology and Agricultural Meteorology - Scope and importance of Agricultural Meteorology - Composition of Atmosphere - Role of greenhouse gases in global cooling and warming - Concept of weather and climate - Micro-meso-macro and phyto climates soil temperature and its variations.

MODULE 2

14 Hrs

Electromagnetic Spectrum - Nature and properties of solar radiation - shortwave radiation and long wave radiation - Radiation balance - Response of plants to solar radiation and photosynthetically active radiation - Thermal structure of atmosphere - vertical profiles - factors affecting surface air temperature - spatial and temporal variations in surface air temperature - soil temperature and its variations - Atmospheric pressure and its variation with height - Global distribution of pressure and wind - Atmospheric humidity - saturation and actual vapour pressure - relative humidity and dew point temperature.

MODULE 3

14 Hrs

Cloud classification and measurements - cloud seeding - Rainfall and its mechanisms - forms and types of rainfall - Indian monsoons - southwest monsoon - northeast monsoon - monsoon variability across Kerala and India - Rainfall over India and Kerala Rainfall and its mechanisms - forms and types of rainfall - Indian monsoons - southwest monsoon - northeast monsoon - monsoon variability across Kerala and India - Rainfall over India and Kerala Role of weather on insect pest and diseases.

MODULE 4

14 Hrs

Importance of weather forecasting in Agriculture - weather service to farmers - agricultural seasons - crop weather diagrams and calendars - crop weather relationships - Role of weather on insect pest and diseases.

MODULE 5

16Hrs

Meteorological and Agrometeorological Stations, Types of agrometeorological Stations. Crop weather diagrams and calendars Preparation of crop weather calendars –Njattuvela calendar-- weather and climate related natural disasters, risk and management - Climate change and global warming - weather modification - Introduction to Remote Sensing.

Text books:

1. Das.P.K. 1968.The Monsoons. NBT, New Delhi.
2. Khadekar, S.R. 2001.Meteorology.Agromet publishers, Nagpur.
3. Mavi, H.S. 1986. Introduction of Agrometeorolgy. Oxford & IBH Publishing Co. New Delhi
4. Menon, P.A. and Rajan, C.K. 1989. Climate of Kerala. Classic publishing house, Kochi.
5. PrasadaRao, G.S.L.H.V. 2005. Agricultural Meteorology. Second Edition.KeralAgricultural University, Thrissur.
6. Sachati, A.K. 1985. Agricultural Meteorology - Instruction-cum-practical manual, NCERT, New Delhi
7. Varshneya, M.C. and BalakrishnaPillai, B. 2003.Textbook of Agricultural

Meteorology.ICAR, New Delhi.

8. Venketaraman, S. and Krishnan, A. 1992.Crops and weather. ICAR, New Delhi.
9. Wilsie, P.C. 1961.Crop Adaptation and distribution. Eurasia Publishing House (P) ltd., New Delhi.

SAG6S1P- Agro Meteorology-Practical

Objectives:

- To study the practical meteorological aspects in relation with crop production.

Credits: 2

36 Hrs

Practical schedule: (4Hrs each)

1. Selection of site and layout of agrometeorological stations and meteorological instruments.
2. Installation of soil thermometers and measurement and recording of soil temperature.
3. Measurement of Relative humidity and vapour pressure and Measurement of Air temperature.
4. Dew point temperature and dew fall.
5. Measurement of rainfall and measurement of wind speed and direction.
6. Measurement of open pan evaporation.
7. Sunshine Recorder and measurement of sunshine.
8. Recording of weather data - tabulation- Processing and presentation Meteorological data.
9. Preparation of crop weather calendars.

Text books:

1. Das.P.K. 1968.The Monsoons. NBT, New Delhi
2. Khadekar, S.R. 2001.Meteorology.Agromet publishers, Nagpur
3. Mavi, H.S. 1986. Introduction of Agrometeorolgy. Oxford & IBH Publishing Co. New Delhi
4. Menon, P.A. and Rajan, C.K. 1989. Climate of Kerala. Classic publishing house, Kochi
5. PrasadaRao, G.S.L.H.V. 2005.Agricultural Meteorology. Second Edition.KeralAgricultural University, Thrissur.
6. Sachati, A.K. 1985. Agricultural Meteorology - Instruction-cum-practical manual, NCERT, New Delhi

SAG6S2T-Farming System Approach for Sustainable Crop Production

(Choice based core)

Credit: 3

54 Hrs

Objectives:

- Familiarising with the Farming System Approach for Sustainable Crop Production
- To make idea about different non-traditional practices in organic farming.

MODULE 1

12 Hrs

Introduction-importance of system approach in crop production, different cropping systems- Terms and definition- Cropping pattern - Multiple cropping and various forms- advantages and disadvantages- Intercropping- ecological basis of intercropping systems- types- sequential cropping and crop rotation-planned crop rotation- Mixed farming and farming systems of Kerala.

MODULE 2

10 Hrs

Crop planning, crop calendar and cropping scheme preparation-factors affecting cropping schemes. Plant interactions- Allelopathy, Competition- Measures to minimize competition- Criteria for assessment of yield advantage, land use efficiency and monetary advantage.

MODULE 3

12 Hrs

Cropping systems prevalent in Kerala-Rice based cropping system- Coconut based multi-tier cropping system- crop cafeteria for multiple cropping- Tapioca based cropping system- Homestead farming in Kerala, Agro forestry - Silviculture, Agrisilviculture, Agrihorticulture, Agrisilvopastoral system, Alley cropping, and Social forestry definitions and - Organic recycling in cropping systems. Important cropping systems in India.

MODULE 4

15 Hrs

Farming systems- components- Livestock- poultry- aquaculture- apiculture- sericulture. Incorporation of components of Integrated farming system in homestead farming. Integrated farming system (IFS) models for uplands and low lands for sustainable and organic agriculture- Evaluation of farming systems.

MODULE 5

5 Hrs

Familiarisation with the organic farming ideas in the book one straw revolution by Masanobu Fukuoka. Introduction to the practices followed by farmers in “zero budget farming”.

SAG6S3T-Disease Management in Crops

(Choice based core)

Credit: 3

54 Hrs

Objectives

- To understand the sustainable disease management strategies in plantation crops and spices.
- To understand the sustainable disease management strategies in vegetables, fruits and field crops.

MODULE I

10 Hrs

Introduction to sustainable Disease Management in crops, importance and history of crop disease management. Different strategies of sustainable disease management- Cultural, Biological, Physical, Chemical control methods, Cross protection and Biotechnological methods, Economic importance - symptoms- causal agents - disease cycle of major plant pathogens.

MODULE 2

12 Hrs

Diseases of plantation crops, Economic importance, symptoms, cause, disease cycle and sustainable management of diseases of: Coconut - Root (wilt) disease, bud rot, leaf rot, stem bleeding, other diseases of unknown etiology in coconut-lethal yellowing. Rubber - Abnormal leaf fall and powdery mildew Tea-Blister blight - grey blight - and thread blight.

MODULE 3

10 Hrs

Diseases of Spices, Economic importance, symptoms, cause, disease cycle and sustainable management of diseases of: Black pepper- foot rot and slow wilt, bacterial leaf spot Ginger: soft rot, leaf spot, and bacterial wilt. Cardamom - azhukal/ capsule rot, clump rot and katte.

MODULE 4

10 Hrs

Diseases of vegetables and their management Economic importance, symptoms, cause, disease cycle and sustainable management of diseases of solanaceous vegetables ,bhindi , vegetable cowpea and cucurbits. Diseases of fruits and their management Economic importance, symptoms, cause, disease cycle and integrated management of diseases of Banana: Viral diseases-Bunchy top, Mosaic, heart rot and Kokkan. Post -harvest diseases- Anthracnose, crown rot and cigar end rot. Mango- mango malformation, anthracnose, powdery mildew, die back, pink disease, sooty mould, black tip.

MODULE 5

12 Hrs

Diseases of field crops and their management Economic importance, symptoms, causal

organisms, epidemiology and sustainable management of diseases of Rice- blast, sheath blight, sheath rot, other diseases of rice - brown spot, false ,udbatta , Bacterial diseases of rice - BLB and bacterial leaf streak; Viral and phytoplasmal diseases - tungro, grassy stunt, mineral deficiency diseases Wheat: rusts, smuts and bunts, tundu.

Text book:

1. Agrios, G.N.1994. Plant Pathology Academy Press. New York.
2. Dasgupta, M.K. 1998. Principles of Plant Pathology. Allied Publishers Pvt. Ltd. Bangalore
3. Maloy.O.C. 1993. Plant Disease control. Principles and Practice. John Wiley and Sons. Inc. New York
4. Singh.R.S 2002.Introduction to Principles of Plant Pathology. Oxford and IBH Publishing, New Delhi.
5. Sharma, P. D. 2001. Plant Pathology, Rastogi publications, shivaji Road, Meerut.

SAG6S2P-Farming System Approach for Sustainable Crop Production-Practical

(Choice based core-practical)

Credit: 2

36 Hrs

(6 Hrs each)

1. Preparation of cropping scheme for irrigated situations.
2. Preparation of cropping scheme for dry land situations.
3. Study of existing farming systems in nearby villages.
4. Preparation of integrated farming system models for wet lands.
5. Preparation of integrated farming system models for dry lands.
6. Visit to research station and farmers field to familiarize with various cropping and farming systems.

AG6S3P-Disease Management in Crops –Practical

(Choice based core-practical)

Credit: 2

36 Hrs

Objectives

- To familiarize with the major diseases in plantation crops, spices, vegetables, fruits and field crops.

(3 Hrs each)

1. Field visits, survey and collection of disease samples and their preservation.

2. Diseases of coconut - economic importance, distribution and symptoms on crown and roots - etiology, disease cycle and integrated management of Root (wilt) disease and bud rot.
3. Economic importance, symptoms, cause, disease cycle and integrated management of diseases of rubber - Abnormal leaf fall, powdery mildew.
4. Economic importance, symptoms, cause, disease cycle and integrated management of Diseases of black pepper - foot rot and slow wilt.
5. Economic importance, symptoms, cause, disease cycle and integrated management of diseases of ginger - soft rot- leaf spot and bacterial wilt.
6. Economic importance, symptoms, cause, disease cycle and integrated management of diseases of cardamom - azhukal/ capsule rot and clump rot and Katte.
7. Study of symptoms, etiology, host-parasite relationship and specific control measures of diseases of solanaceous vegetables.
8. Study of symptoms, etiology, host-parasite relationship and specific control measures of diseases of Bhendi and cowpea
9. Study of symptoms, etiology, host-parasite relationship and specific control measures of diseases of cucurbits.
10. Study of symptoms, etiology, host-parasite relationship and specific measures of management of diseases of Banana
11. Study of symptoms, etiology, host-parasite relationship and specific measures of management of diseases of mango
12. Study of symptoms, etiology, host-parasite relationship and specific control measures of important diseases of rice.

SAG6G1T-Government Policies and Programmes related to agriculture

Credit: 4

72 Hrs

Objectives

- To acquaint with various Government Policies related to Agriculture in Kerala and India.
- To familiarise with five year plans and Panchayathiraj system in India.

MODULE 1 Introduction to agricultural policies

8 Hrs

Introduction to agricultural policies of Kerala and of India - need and importance - National Agricultural Policy in brief.

MODULE 2 Agricultural policies regarding land and labour **15 Hrs**

Agricultural policies regarding land - need and scope for land reforms - Abolition of intermediaries - Tenancy reforms - Ceiling on land holdings - appraisal of land reforms.- Size pattern of operational holdings, problem of sub-division and fragmentation of holdings. Agricultural policies regarding labour - present position of agricultural labour - minimum wages - abolition of bonded labour - Recommendations of the National Commission on Rural Labour – NREGP.

MODULE 3 Agricultural policies regarding seeds and fertilizers **15 Hrs**

Agricultural policies regarding seeds - National Seeds Policy -varietal development and plant variety protection - seed production - quality assurance - seed distribution and marketing - infrastructure facilities - transgenic plant varieties - import of seeds and planting material - export of seeds -promotion of domestic seed industry Agricultural policies regarding fertilizers - Fertilizer pricing policy - payment of subsidy. Agricultural policies regarding plant protection chemicals - pesticide production and consumption in India - protection of consumers from adverse impacts of pesticides. Agricultural policies regarding irrigation, machinery, technology etc.

MODULE 4 Agricultural policies regarding credit **16 Hrs**

Agricultural policies regarding credit - Co-operatives and rural credit - Commercial banks and rural credit - Regional Rural Banks - Lead Bank Scheme - NABARD. Agricultural policies of Kerala and of India- regarding agricultural products and their marketing, export and prices - food security.

MODULE 5 Five Year plans and Panchayathiraj **18 Hrs**

Concept of planned growth- Five Year Plans-Government policies and programs in agriculture and rural development. IADP - IAAP- IWDP- Watershed development Programmes- IRDP- NREGP- SGSY - Kudumbasree- etc. Peoples' Plan- Decentralised planning- current Plans - Agricultural development programmes and schemes of the dept. of Agriculture- liaison with Local Self Government. Panchayati raj system and institutions- gramasabha- Preparation of plan projects in agriculture.

Text books:

1. Government of India. Five year Plan Documents.
2. Government of India.Economic Survey. Published by Planning Commission (various issues)
3. Government of India.Economic Review. Published by State Planning Board (various issues)

SAG6G2T - COMPUTER HARDWARE AND NETWORKING

Credit: 4

72 Hrs

Objectives

- Understand the hardware components of a system.
- Understand basic issues in installing and using software.
- Understand how a network functions and the issues of network security.

Module 1- Basics of Computer and Hardware

10 Hrs

Input & Output Devices, their types and specifications, CPU, Memory devices- types primary and secondary, BIOS/ CMOS setting.

Module 2- Mother Board

10 Hrs

Study of Motherboard RAM,ROM,CMOS,POST, BUS, (Address, Data, SYSTEM), Connections of various devices such as Display Adapter, Ports (Serial, Parallel) , Modem on the Mother Board, Importance of CPU cooling, Motherboard troubleshooting.

Module 3- Serial Devices

10 Hrs

Key Board: Switches, Keyboard organization, Key board type, Wireless Keyboard Trouble shooting. Mouse: Mouse type- Scroll & Optical Mouse, Function Connecting Mouse, Trouble shooting Mouse. FILE SYSTEM: Types of file Sequential, index, direct access, creation and updates of file and access method.

Module 4- Storage Devices

13 Hrs

HDD: HDD types, integrated, SCSI, Magnetic recording, Formatting (Track, Sector) Cluster, Bad Sector, Jumper Setting, Common Problem and its trouble Shooting, External Drive (HDD), Optical Drives. FDD: FDD types and working and its related problem, CD and DVD drives- ROM and Writer, USB Devices, Hub, Pen Drives.

Module 5-Parallel Devices

13 Hrs

Printers: Working of DMP, Ink Jet, Laser Printer, line printer, MFP (Multi Functional Printer and its Trouble shooting, Scanners, BOOT PROCESS, POWER SUPPLY, TYPES OF PC'S : Desktop, Laptop, Palmtop.

Module 6 - Introduction to LAN and WAN networking

16 Hrs

Emergence and history of network, What is network, Need of network or benefits of network, Types of networks -LAN and WAN, How to assign IP address mask and gateway, Familiar with ping, ipconfig/all netstat and tracert commands, Types of wan technologies, Explain about structure of intranet and internet.

Text books:

1. The Indispensable PC Hardware Book (4th Edition) by Hans-Peter Messmer.
2. USB Mass Storage by Jan Axelson.
3. Bigelow's PC Hardware Desk Reference – 2002 by Stephen J. Bigelow
4. PC Architecture. An online book in by Michael Karbo.

SAG6S11**Agricultural engineering****Credit: 5****Work planned:**

Setting up a polyhouse for seedling production with drip irrigation facility and a hardening unit with mist propagation in farmers field as a part of *earn while you learn* programme.

SAG6GP1**Project/Dissertation****Credit: 6****108 Hrs****Details of Project Work**

Industrial training will be conducted at the industrial premises engaged in agriculture an allied activities. A group of students (5-6 number) will be allotted to each industry. The interest of the students will be one of the major criteria in selecting the category of industry. A project report of the industrial training shall be submitted at the end of sixth semester and a viva-voce will be conducted by a panel of three subject experts.

Note: In addition to practical hours, for certain time bound operations; the students will complete the work after the regular class hours.

COMPLEMENTARY COURSE

FOOD PROCESSING

SEMESTER-1

FPR1G1T- BASIC PRINCIPLES OF FOOD PROCESSING

Credit: 2

36 Hrs

Objectives

- To provide a basic sequence of steps to produce an acceptable and quality food product from raw materials.
- Study of scientific and technological advancements in food processing.

Module 1- Classification of Food

8hrs

Definition of food, classification of foods- based on origin, pH, nutritive value, functions of food, Health food, ethnic food, organic food, functional food, nutraceuticals.

Module 2-Fundamentals of Food Processing

8hrs

Steps involved in converting a raw harvested food materials to a preserved product with sound quality- harvesting, storage, manufacturing, preservation, packaging, distribution and marketing.

Module 3- Post Harvest Management

6hrs

Chemical, enzymatic, physical and biological deterioration, implications and prevention.

Module 4-Ethnic Foods and its Processing

7hrs

Banana products- banana puree, banana chips, banana powder, Banana figs, banana flour; Tapioca products- Tapioca chips, tapioca powder.

Module 5-Processing of Modern Foods

7hrs

Pasta, Macaroni, Noodles, Mayonnaise, Salad Dressing, Margarine, Potato wafers, Corn flakes, Pop corn.

Text books:

1. Brian E. Grimwood, Coconut Palm Products: Their Processing in Developing Countries, 1979.
2. Hui, Y H and Associate Editors; Hand Book of Food Products Manufacturing Vol I, Wiley- Interscience, New Jersey 2007.
3. Hui, Y H and Associate Editors; Hand Book of Food Products Manufacturing Vol II, wiley- Interscience, New Jersey 2007.

4. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
5. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
6. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

FPR1G1P- BASIC PRINCIPLES OF FOOD PROCESSING-Practical

Credit: 1

18 Hrs

Objectives

- To study the manufacture of various food products
 1. Preparation of mayonnaise 3hrs
 2. Preparation of peanut butter 5hrs
 3. Preparation of potato chips 3hrs
 4. Preparation of tapioca chips 2hrs
 5. Preparation of banana chips 2hrs
 6. Preparation of banana puree 3hrs

Text Books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
3. Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

SEMESTER-2

FPR2G1T-FRUIT AND VEGETABLE PROCESSING TECHNOLOGY

Credit: 2

36 Hrs

Objectives

- To provide a basic understanding of processing of fruits and vegetables.

Module 1- Introduction**8hrs**

Ripening and quality of fruits, harvesting and transportation, cold storage of fruits, selection and preparation of fruits for processing, deskinning, enzyme inactivation, packing and processing.

Module 2- Processing of juice, jam and jelly**8hrs**

Fruit juice manufacture, Canning of fruit juices, freezing of fruit pulps. Aseptic processing of fruit juices. Packaging of aseptically processed juices and pulps. Concentrated fruit juices. Manufacture of jams. Theory of jelly formation, ingredients. Machinery. Jellies, marmalades, squashes, cordials, syrups, specifications.

Module 3- Processing of tomato, apple and orange**5hrs**

Tomato juice, canned whole tomatoes, tomato ketchup, tomato jams, tomato puree, tomato powder. Apple and apple product- Clarified apple juice, aseptically packed apple puree, apple cider, orange products- orange juice, concentrated orange juice, orange squash, orange jams.

Module 4- Processing of pineapple and mango**8hrs**

Pineapple products- juice, jam, canning, Mango and mango products- raw unripe mango products: brined mango slices, dried green mango slices and powder (Amchur), canned mango slices in syrup, canned or frozen mango pulp, mango juice or mango nectar, mango jam, mango squash, mango juice powder, mango freeze dried products, mango syrup.

Module 5- Processing of vegetables**7hrs**

Processing of okra (ladies finger), potatoes, onions, carrots, green peas, procuring, transportation, storage, processing, packaging and ware housing.

Text books:

1. Siddappa and Bhatia, Fruits and Vegetable Processing Technology
2. Lea, R. A. W, Fruit juice processing and packaging
3. Hui, Y. H. Processing of fruits
4. Cash J. N. Processing of vegetables
5. Jongen, W. Fruit and vegetable processing

FPR2G1P- FRUIT AND VEGETABLE PROCESSING TECHNOLOGY-PRACTICAL**Credit: 1****Hrs: 18 Hrs****Objectives**

- To familiarize the students with processing of fruits and vegetables

1. Processing of mango squash	3hrs
2. Processing of pineapple jam	5hrs
3. Manufacture of tomato puree	2hrs
4. Manufacture of tomato sauce	4hrs
5. Manufacture of tomato ketchup	4hrs

Text books:

1. Siddappa and Bhatia, Fruits and Vegetable Processing Technology
2. Lea, R. A. W, Fruit juice processing and packaging
3. Jongen, W. Fruit and vegetable processing

SEMESTER-3

FPR3G1T-CEREALS AND PULSES PROCESSING TECHNOLOGY

Credit: 2

Hrs: 36

Objectives

- To give a general outline about the principles, structure and composition, economic importance, storage and processing of different cereals, pulses and their products.

Module 1- Rice

9hrs

Cereal grain structure, composition of rice, Processing- Milling, parboiling– Avorio process, conversion process, Malek process and Fernandez process and its advantages, by-products of cereals– starch, gluten, dextrose, dextrin, bran, broken grains, parched rice, puffed rice, flaked rice, popped rice, hulls, rice pollards, bran oil, germ and germ oil, husk, straw.

Module 2- Wheat

8hrs

Classification of wheat, structure and composition, Harvesting and storage: wheat milling, wheat products: whole wheat flour, maida, semolina, macaroni products and its method of preparation: macaroni, spaghetti and vermicelli.

Module 3- Millets

6hrs

Corn- types of corn, structure and composition, nutritive value, processing of corn: dry milling, wet milling and alkali processing, products of corn: degerminated flour, corn germ oil, pop corn, corn starch. Jowar, Ragi, Bajra and Rye: Nutritive value and processing.

Module 4- Breakfast cereals

6hrs

Definition, Nutritive value of breakfast cereals, and classification of breakfast cereals: uncooked breakfast cereals and ready to eat cereals: processing of ready –to-eat cereals

(Batch cooking, continuous cooking and extrusion cookers) and products (flaked cereals, puffed cereals, shredded products, granular products).

Module 5- Pulses

7hrs

Introduction, composition, processing, utilization of pulses, toxic constituents of pulses, important pulses- Bengal gram, red gram, black gram, green gram, moth bean, lentil, horse gram, field bean, pea, khesari dhal, cluster bean, cow pea, kidney bean, soyabean- processing, fermented products of soyabean.

Text books:

1. David Dendy A.V, etal; *Cereals and Cereal Products: Technology and Chemistry*, - 2000
2. Manay, N.S, Shadaksharaswamy, M., *Foods- Facts and Principles*, New Age International Publishers, New Delhi, 2004.
3. Potter, N.N. and Hotchkiss J. H. *Food Science*. CBS publishers and distributors. 1996.
4. Srilakshmi, B. *Food Science*. New Age International Publishers, New Delhi, 2003.
5. Subalakshmi, G and Udipi, S.A. *Food processing and preservation*. New Age International Publishers, New Delhi, 2001.

FPR3G1T - CEREALS AND PULSES PROCESSING OF CEREAL PRODUCTS

Objectives:

- To give a general outline of the processing of different cereals, pulses and their products.

Credit: 1

Hrs: 18

- | | |
|---------------------------|-------|
| 1. Manufacture of bread | 8 hrs |
| 2. Manufacture of cake | 4 hrs |
| 3. Manufacture of biscuit | 6 hrs |

Text Books:

1. Manay, N.S, Shadaksharaswamy, M., *Foods- Facts and Principles*, New Age International Publishers, New Delhi, 2004.
2. Potter, N. N, Hotchkiss, J. H. *Food Science*. CBS Publishers, New Delhi. 2000.
3. Srilakshmi, B. *Food Science* (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

SEMESTER-4

FPR4G1T- FATS AND OIL PROCESSING TECHNOLOGY

Credit: 2

36 Hrs

Objectives

- To give a general outline about the principles, structure and composition, economic importance, storage and processing of fats and oils and their products.

Module1- Introduction

8hrs

Fats and oils, classification, properties, uses in food industry, shortenings, recent processing techniques.

Module 2- Processing of oil

9hrs

Steps involved in oil processing, oil extraction, methods of oil extraction, oil refining, hydrogenation, winterization, deodorizing, bleaching.

Module 3- Oil extraction from oil seeds

6hrs

Major and minor oil seeds, sources, examples, Extraction of oil from oil seeds, hydrogenated vegetable oils, margarine.

Module 4- Fat Characterization

7hrs

Importance of fat analysis, refractive index, melting point, solid fat index, cold test, smoke, flash and fire points, iodine value, saponification number, acid value and free fatty acids, polar components in frying fats, lipid oxidation, peroxide value, Thiobarbituric acid test, Schaal Oven test, active oxygen method.

Module 5- Packing and storage

6hrs

Packing, packaging materials, factors to be considered during packing, antioxidants, storage.

Text books:

1. Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Meyer, L H-Food Chemistry. CBS publishers & distributors, New Delhi. 2002
3. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
4. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003
5. Lawson, G. L, Food oils and fats
6. Fereidoon Shahidi, Functional properties of proteins and lipids
7. Clyde, E. Stauffer, Fats and oils

FPR4G1P - FAT ANALYSIS-PRACTICAL

- To give foundation to fat analysis

Credit: 1	18 Hrs
1. Refractive index	1hr
2. Melting point	1hr
3. Solid fat index	2hrs
4. Cold test	2hrs
5. Iodine value	5hrs
6. Saponification number	3hrs
7. Acid value and free fatty acids	4hrs

Text books:

1. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London. 2003
2. Lawson, G. L, Food oils and fats
3. Meyer, L H-Food Chemistry. CBS publishers & distributors, New Delhi. 2002
4. Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
5. Fereidoon Shahidi, Functional properties of proteins and lipids
6. Clyde, E. Stauffer, Fats and oils.

COMPLEMENTARY COURSE
ENERGY AND ENVIRONMENTAL STUDIES

SEMESTER-1

EES1G1T - RENEWABLE ENERGY SOURCES

Credits: 3

54 hrs

Course Objectives:

- To explain concept of various forms of renewable energy
- To outline division aspects and utilization of renewable energy sources for both domestic and industrial applications

Module 1

12 hrs

Indian Energy Sector – Organizational Structure – Energy Supply -Coal, Lignite, Oil, Gas and Powers – Hydro, Nuclear, Thermal – Energy Demand -Agriculture, Industry, Transport, Domestic, etc – Renewable Energy Sources and Technology - Renewable Energy Programmes -Energy Issues and Policy Options for India.

Module 2

12 hrs

Solar Energy, Solar Energy potential, solar radiation and Measurement, types of solar energy collectors. Solar water heating systems, Solar air heating and cooling systems. Solar thermal energy conversion, solar photo voltaic system.

Module 3

12 hrs

Wind Energy, Scope for Wind energy in India, Basic principles of wind energy conversion, Site selection considerations, Basic components of wind energy conversion system, Types of wind machines, Performance of Wind machines, Application of Wind Energy.

Module 4

12 hrs

Biomass and Biogas energy, Introduction, Biomass conversion technologies, Methods of obtaining energy from biomass, Biogas generation, Classification of biogas plants, Factors affecting yield of biogas plants, Properties & Characteristics of Biogas, Utilization of Biogas.

Module 5

6 hrs

Other sources of renewable energy, Tidal Energy, Geothermal Energy, Magneto – Hydro Dynamic energy, Chemical energy Sources, Hydrogen Energy.

Text books:

1. Solar Energy Utilization, G. D. Rai, Khanna & Khanna, New Delhi.

2. Non conventional energy source, G. D. Rai, Khanna & Khanna, New Delhi.
3. Sustainable Energy, J. W. Tester & M. Drate, Prentice Hall of India, New Delhi.
4. Principles of Power system, V. K. Meththa, S.Chand Co.Ltd., New Delhi.
5. Raikhy, P.S. and Parminder Singh, (1990) : Energy Consumption in India – Pattern and Determinants, Deep and Deep, New Delhi.

SEMESTER-2

EES2G1T -INTRODUCTORY ENVIRONMENTAL STUDIES

Credits: 3

54 hrs

Course Objectives:

- To create awareness about the importance of environment, its ecological balance and make him/her sensitive to the environment issues in every endeavor that he/she participates.

Module 1

20 Hrs

Environmental studies, Definition, Scope and Importance – Need For Public Awareness – Forest Resources:- Use and Over - Exploitation, Deforestation, Case Studies, Mining, Dams and their Ground Water, Floods, Drought, Conflicts Over Water, Dams – Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Land Resources:- Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable use of Resources for Sustainable Lifestyles. **Module 2**

20 Hrs

Concepts of an Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the Forest Ecosystem Grassland Ecosystem Desert Ecosystem Aquatic Ecosystems – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Bio-geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-

Wildlife Conflicts – endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

Module 3

14 Hrs

Environmental pollution Definition – Causes, Effects and Control Measures of:- Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards – Soil Waste Management:- Causes, Effects and Control Measures of Urban and Industrial Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management:- Floods, Earthquake, Cyclone and Landslides.

Text Books:

1. Masters, G.M., “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., 2nd Edition, 2004.
2. Miller, T.G. Jr., “Environmental Science”, Wadsworth Pub. Co.
3. Townsend C., Harper, J. and Begon, M., “Essentials of Ecology”, Blackwell Science, 2003.
4. Trivedi, R.K., and Goel, P.K., “Introduction to Air Pollution”, Techno- Science

SEMESTER-3

EES3G1T - ENVIRONMENTAL IMPACT ASSESSMENT

Credits: 3

54 hrs

Course Objectives:

- To have an assessment of the impacts of manmade activities on the environment.
- To have an understanding of the possible remedies in this regard.

Module 1

13 Hrs

Social issues and the environment, From Unsustainable To Sustainable Development – Urban Problems Related To energy – Water conservation, Rain Water Harvesting, Watershed Management – Environmental Ethics:- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies – Wasteland Reclamation – Consumerism and Waste Products.

Module 2

13 Hrs

Basic concept of EIA: Initial environmental Examination, Elements of EIA, - factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods,

Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Module 3

14 Hrs

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of activities. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

Module 4

14 Hrs

E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, generalized approach for assessment of Air pollution Impact. Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Text books:

1. Y. Anjaneyulu, *Environmental Impact Assessment Methodologies*, B.S. Publication, Sultan Bazar, Hyderabad. 2002
2. J. Glynn and Gary W. Hein Ke *Environmental Science and Engineering*, Prentice Hall Publishers 2000
3. Suresh K. Dhaneja – S.K., *Environmental Science and Engineering*, Katania & Sons Publication. New Delhi.1998
4. Dr H.S. Bhatia *Environmental Pollution and Control*, Galgotia Publication (P) Ltd, Delhi, 1996

SEMESTER-4

EES4G1T -ENERGY AND ENVIRONMENT MANAGEMENT

Credits: 3

54 hrs

Course Objectives:

- To understand the methodology of energy management.
- To understand the methodology of environment management.
- To understand energy and environment audit.

Module 1

12 Hrs

Energy Crisis – Causes and Consequences – Remedial Measures – Environmental Crisis – Causes and Consequences – Remedial Measures – Impact of Energy Consumption and

Production on Environment with illustrations – Role of Energy and Environmental Economists in solving Energy the crises.

Module 2

12 Hrs

Energy Planning and Energy Conservation – Meaning, Objectives and Importance – Energy Management – Meaning, Objectives and Importance – Recent Developments – Energy Auditing – Energy Accounting – Energy Pricing and Taxes – Role of Economists in Promoting Sustainable Energy Management.

Module 3

20 Hrs

Internal Audit, External Audit, Energy Audit: Preliminary Energy Audit, Detailed Energy Audit, Investment Grade Energy Audit, Industrial Energy Audit, Utility (Services) Energy Audit, Commercial Energy Audit, Residential Energy Audit. Energy Audit Strategies: Monitoring and Control, Questioning the Need, Minimizing the Need of End Use, Minimizing the Losses, Operating the Equipment at Optimum Efficiency, Operating the Most Efficient Equipments from Set of Equipments, Minimizing the Idle Redundant Running, Proper Maintenance of the Equipment, Fuel Substitutions, Quality Control and Recycling.

Module 4

10 Hrs

Environmental Auditing: Types of audits: EMS audits, performance audits, compliance audits; ISO 19011 and environmental auditing; Methodologies for Environmental Auditing: Objectives, audit teams, planning audits, conducting audits, reporting audit findings; Legal Requirements relating to Environmental auditing. Post Audit activities, The Environmental pollution Act.

Text Books:

1. Instructions to Energy Auditors, Vol. - I & Vol. - II –National Technical Information Services U. S. Dept. Of Commerce Springfield, VA 22161.
2. Energy Auditing, The Fairmont Press Inc. Published by Atlanta, Georgia
3. Albert Thumann, P.E., C.E.M. , Plant engineers & Managers Guide To Energy Conservation 8th edition-2002, Published By The Fairmont Press , Inc 700 Indian Trail Liburn, GA30047
4. Karpagam, M. (1991) : Environmental Economics, Sterling, New Delhi.
5. Raikhy, P.S. and Parminder Singh, (1990): Energy Consumption in India – Pattern and Determinants, Deep and Deep, New Delhi.

B.Voc - Sustainable Agriculture

Detailed Scheme for the Distribution of Credits and Period of Instruction

Total Credits per semester = 30, Total Credits for the course = 180

Total contact hours per week = 25, Total contact hours per semester = 450

(Course Code details: SAG-Sustainable AGRiculture, FPR-Food Processing, EES-Energy and Environmental Studies, 1- First Semester, S-Skill Development, 1T-First Theory Paper, 2T- Second Theory Paper, P- Practical, G-General Education, I- Internship/training.)

First Semester								
Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
1	Skill Development (Core)	SAG1S1T	Fundamentals of Agronomy	3	3	3	54	
2	Skill Development (Core)- Practical	SAG1S1P	Fundamentals of Agronomy-Practical	3	2	2	36	
3	Skill Development (Core)	SAG1S2T	Fundamentals of Horticulture	3	3	3	54	
4	Skill Development (Core)- Practical	SAG1S2P	Fundamentals of Horticulture – Practical	3	2	2	36	
5	Skill Development (Core)	SAG1S3T	Fundamentals of Entomology and insect ecology	3	2	2	36	
6	Skill Development (Core)- Practical	SAG1S3P	Fundamentals of Entomology and insect ecology-Practical	3	2	2	36	
7	General Education	ENCN1	Communication skills in English	3	6	5	90	

	(Common course)							
8	General Education (Complementary) Food processing	FPR1G1T	Basic Principles of Food processing	3	2	2	36	
9	General Education (Complementary- Practical) Food Processing – Practical	FPR1G1P	Basic Principles of Food Processing – Practical	3	1	1	18	
10	General Education (Complementary) Energy and Environmental studies	EES1G1T	Renewable Energy Sources	3	3	3	54	
11	Skill Development Internship/Trainin g	SAG1S1I	Setting up of crop museum	Internal Evaluation	4	-	-	
TOTAL					30	25	450	30
Second semester								
Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
12	Skill Development (Core)	SAG2S1T	Plantation Crops, Spices and Fruits	3	3	3	54	
13	Skill Development	SAG2S1P	Plantation Crops, Spices and Fruits-	3	2	2	36	

	(Core)- Practical		Practical					
14	Skill Development (Core)	SAG2S2T	Fundamentals of Plant Breeding and Seed technology	3	2	2	36	
15	Skill Development (Core)- Practical	SAG2S2P	Fundamentals of Plant Breeding and Seed technology - Practical	3	2	2	36	
16	Skill Development (Core)	SAG2S3T	Fundamentals of Agricultural Engineering	3	2	2	36	
17	Skill Development (Core)- Practical	SAG2S3P	Fundamentals of Agricultural Engineering - Practical	3	3	3	54	
18	General Education (Common course)	ENCN2	Critical Thinking, Academic Writing & Presentation	3	6	5	90	
19	General Education (Complementary) Food processing	FPR2G1T	Fruit and vegetable processing technology	3	2	2	36	
20	General Education (Complementary – Practical) Food processing-practical	FPR2G1P	Fruit and vegetable processing technology - Practical	3	1	1	18	
21	General Education (Complementary) Energy and Environmental studies	EES2G1T	Introductory Environmental Studies	3	3	3	54	
22	Skill Development Internship/Training	SAG2SI1	Cultivation of coconut and banana	Internal Evaluation	4	-	-	

TOTAL					30	25	450	30
Third Semester								
Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
23	Skill Development (Core)	SAG3S1T	Fundamentals of Plant Pathology and crop disease management	3	4	4	72	
24	Skill Development (Core)- Practical	SAG3S1P	Fundamentals of Plant Pathology and crop disease management -Practical	3	2	2	36	
25	Skill Development (Core)	SAG3S2T	Protected cultivation of Horticultural crops	3	3	3	54	
26	Skill Development (Core)- Practical	SAG3S2P	Protected cultivation of Horticultural crops -Practical	3	3	3	54	
27	Skill Development (Core)	SAG3S3T	Integrated pest management in crops	3	3	3	54	
28	Skill Development (Core)- Practical	SAG3S3P	Integrated pest management in crops - Practical	3	1	1	18	
29	Skill Development (Core)	SAG3S4T	Plant Physiology	3	2	2	36	
30	Skill Development (Core)- Practical	SAG3S4P	Plant Physiology-Practical	3	1	1	18	
31	General Education (Complementary) Food Processing	FPR3G1T	Cereals and pulses processing technology	3	2	2	36	

32	General Education (Complementary – Practical) Food Processing- Practicals	FPR3G1P	Cereals and pulses processing technology- practical	3	1	1	18	
33	General Education (Complementary) Energy and Environmental studies	EES3G1T	Environmental impact assessment	3	3	3	90	
34	Skill Development Internship/Trainin g	SAG3GI1	Cultivation of rice	Internal evaluatio n	5	-	-	
TOTAL					30	25	450	30

Fourth Semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
35	Skill Development (Core)	SAG4S1T	Weed management and fodder Crop Production	3	4	4	72	
36	Skill Development (Core)- Practical	SAG4S1P	Weed management and fodder Crop Production -Practical	3	2	2	36	
37	Skill Development (Core)	SAG4S2T	Livestock Farming	3	3	3	54	
38	Skill Development	SAG4S2P	Livestock Farming -Practical	3	2	2	36	

	(Core)- Practical							
39	Skill Development (Core)	SAG4S3T	Farm Power and Machinery	3	3	3	54	
40	Skill Development (Core)- Practical	SAG4S3P	Farm Power and Machinery - Practical	3	2	2	36	
41	Skill Development (Core)	SAG4S4T	Commercial vegetable production	3	2	2	36	
42	Skill Development (Core)- Practical	SAG4S4P	Commercial vegetable production Practical	3	1	1	18	
43	General Education (Complementary) Food Processing	FPT4G1T	Fats and oil processing technology	3	2	2	36	
44	General Education (Complementary – Practical) Food Processing- Practical	FPT4G1P	Fat analysis- Practical	3	1	1	18	
45	General Education (Complementary) Energy and Environmental studies	EES4G1T	Energy and Environment Management	3	3	3	54	
46	Internship/Training	SAG4GI1	Agricultural Engineering- Farm Machinery Setting up of a Kitchen Garden	Internal evaluation	5	-	-	
TOTAL					30	25	450	30

Fifth Semester

Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
47	Skill Development (Core)	SAG5S1T	Landscape designing and indoor gardening	3	2	2	36	
48	Skill Development (Core)- Practical	SAG5S1P	Landscape designing and indoor gardening- Practical	3	2	2	36	
49	Skill Development (Core)	SAG5S2T	Commercial enterprises	3	3	3	54	
50	Skill Development (Core)- Practical	SAG5S2P	Commercial enterprises -Practical	3	2	2	36	
51	Skill Development (Core)	SAG5S3T	Fundamentals of organic farming	3	2	2	36	
52	Skill Development (Core)- Practical	SAG5S3P	Fundamentals of organic farming – Practical	3	2	2	36	
53	General Education	SAG5G1T	Principles of Agribusiness Management	3	4	4	72	
54	General Education	SAG5G2T	Tissue Culture	3	3	3	54	
55	General Education	SAG5G2P	Tissue Culture - Practical	3	2	2	36	

56	Open Course General Education	SAG5G3T	Course offered by other departments in the college	3	3	3	54	
57	Skill Development Internship/Training	SAG5SI1	Sustainable Agriculture & Organic farming	Internal evaluation	5	-	-	
TOTAL					30	25	450	30
Sixth Semester								
Sl. No	Type of course	Course code	Title of course	Exam duration	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the semester
58	Skill Development (Core)	SAG6S1T	Agro Meteorology	3	4	4	72	
59	Skill Development (Core)- Practical	SAG6S1P	Agro Meteorology--Practical	3	2	2	36	
60	Skill Development (Core) Choice Based Core Course	SAG6S2T or SAG6S3T	Farming System Approach for Sustainable Crop Production or Disease management in crops	3	3	3	54	
61	Skill Development (Core)- Practical	SAG6S2P	Farming system Approach for Sustainable	3	2	2		

	Choice Based Core Course- Practical	or SAG6S3P	Crop Production–Practical or Disease management in crops -Practical				36	
62	General Education	SAG6G1T	Government Policies and Programmes related to agriculture	3	4	4	72	
63	General Education	SAG6G2T	Computer hardware and networking	3	4	4	72	
64	Skill Development Internship/ Training	SAG6SI1	Agricultural engineering	Internal evaluation	5	--	--	
65	Skill development Project/ Dissertation	SAG6GP1	Project/Dissertation	Viva voce	6	6	108	
TOTAL					30	25	450	30