

Agriculture

LIST OF COURSES

S.No.	Course Code	Name of the Course	Credits
Agriculture			
1	18AG1001	Fundamentals of Agronomy	3:0:1
2	18AG1002	Agricultural Heritage	1:0:0
3	18AG1003	Introductory Agricultural Meteorology and Climate Change	1:0:1
4	18AG1004	Fundamentals of Plant Biochemistry	2:0:1
5	18AG1005	Agricultural Microbiology	2:0:1
6	18AG1006	Rural Sociology and Educational Psychology	2:0:0
7	18AG1007	Irrigation Water management	1:0:1
8	18AG1008	Principles of Genetics and Cytogenetics	2:0:1
9	18AG1009	Fundamentals of Crop Physiology	2:0:1
10	18AG1010	Fundamentals of Plant Pathology	2:0:1
11	18AG1011	Fundamentals of Entomology	2:0:1
12	18AG1012	Fundamentals of Agricultural Economics	2:0:0
13	18AG1013	Fundamentals of Soil Science	2:0:1
14	18AG1014	Fundamentals of Agricultural Extension Education	2:0:1
15	18AG1015	Introduction to Agriculture and Horticulture	2:0:0
16	18AG1016	Introductory Agro Forestry	1:0:1
17	18AG1017	Weed Management	1:0:1
18	18AG1018	Production Technology for Vegetable, Fruit and Plantation Crops	2:0:1
19	18AG2001	Principles of Plant Breeding	2:0:1
20	18AG2002	Crop Production Technology – I (Kharif Crops)	1:0:1
21	18AG2003	Agricultural Finance and Cooperation	2:0:1
22	18AG2004	Production Technology for Vegetables	1:0:1
23	18AG2005	Livestock and Poultry Management	3:0:1
24	18AG2006	Agri Informatics	1:0:1
25	18AG2007	Farming Systems and Sustainable Agriculture	1:0:0
26	18AG2008	Crop Production Technology –II (Rabi Crops)	1:0:1
27	18AG2009	Production Technology for Ornamental Crops and Landscaping	1:0:1
28	18AG2010	Production Technology for Fruit and Plantation Crops	1:0:1
29	18AG2011	Principles of Seed Technology	1:0:1
30	18AG2012	Problematic Soils and their Management	2:0:0
31	18AG2013	Agricultural Marketing, Trade and Prices	2:0:1
32	18AG2014	Introduction to Biotechnology	1:0:1
33	18AG2015	Environmental Studies and Disaster Management	2:0:1
34	18AG2016	Medicinal and Aromatic Plants	1:0:1
35	18AG2017	Study Tour – I	0:0:1
36	18AG2018	Practical Crop Production (Kharif crops)	0:0:2
37	18AG2019	Crop Improvement – I (Kharif crops)	1:0:1
38	18AG2020	Manures, Fertilizers and Soil Fertility Management	2:0:1
39	18AG2021	Diseases of Field and Horticultural Crops and their Management –I	2:0:1
40	18AG2022	Principles of Integrated Pest and Disease Management	2:0:1
41	18AG2023	Pests of Crops, Stored Grains and their Management	2:0:1
42	18AG2024	Precision Farming	1:0:1

43	18AG2025	Entrepreneurship Development and Business Management	1:0:1
44	18AG2026	Intellectual Property Rights	1:0:0
45	18AG2027	Rainfed Agriculture and Watershed Management	1:0:1
46	18AG2028	Practical Crop Production (Rabi crops)	0:0:2
47	18AG2029	Principles of Organic Farming	1:0:1
48	18AG2030	Diseases of Field and Horticultural Crops and their Management –II	1:0:1
49	18AG2031	Post-harvest Management and Value Addition of Fruits and Vegetables	2:0:1
50	18AG2032	Crop Improvement - II (Rabi crops)	1:0:1
51	18AG2033	Management of Beneficial Insects	1:0:1
52	18AG2034	Farm Management, Production and Resource Economics	1:0:1
53	18AG2035	Principles of Food Sciences and Nutrition	1:0:1
54	18AG2036	Study Tour – II	0:0:1
55	18AG3037	Spices, Medicinal and Aromatic Crops	2:0:1
		Horticulture	
1	18HO1001	Fundamentals of Horticulture	2:0:1
2	18HO1002	Growth and Development of Horticultural Crops	2:0:1
3	18HO1003	Propagation and Nursery Management for Horticultural Crops	2:0:1
4	18HO1004	Production Technology of Tropical and Subtropical Fruits	2:0:1
5	18HO1005	Production Technology of Tropical and Subtropical Vegetables	2:0:1
6	18HO1006	Irrigation and Weed Management in Horticultural Crops	2:0:1
7	18HO2001	Commercial Floriculture	2:0:1
8	18HO2002	Production Technology of Spices and Plantation Crops	2:0:1
9	18HO2003	Precision Farming and Protected Cultivation	2:0:1
10	18HO2004	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	2:0:1
11	18HO2005	Soil Fertility and Nutrient Management	1:0:1
12	18HO2006	Production Technology of Temperate Vegetable Crops	1:0:1
13	18HO2007	Production Technology of Temperate Fruit Crops	1:0:1
14	18HO2008	Production Technology of Medicinal and Aromatic Crops	2:0:1
15	18HO2009	Breeding of Vegetables, Medicinal and Aromatic Crops	3:0:1
16	18HO2010	Diseases of Vegetables, Flowers, Ornamentals and Spice Crops	2:0:1
17	18HO2011	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	2:0:1
18	18HO2012	Study Tour – I	0:0:1
19	18HO2013	Principles of Ornamental Horticulture and Landscape Architecture	2:0:1
20	18HO2014	Dryland Horticulture	2:0:1
21	18HO2015	Breeding of Fruits, Spices and Plantation Crops	2:0:1
22	18HO2016	Seed Production of Vegetable, Tuber and Spice Crops	2:0:1
23	18HO2017	Insect Pests of Vegetable, Ornamental and Spice Crops	2:0:1
24	18AG2029	Principles of Organic farming	1:0:1
25	18HO2018	Introduction to Major Field Crops	1:0:1
26	18HO2019	Economics and Marketing	2:0:1
27	18HO2020	Horti-Business Management	2:0:1
28	18HO2021	Post-harvest Management and Processing of Horticultural Crops	2:0:2

29	18HO2022	Breeding and Seed Production of Flower and Ornamental Plants	2:0:0
30	18HO2023	Nematode Pests of Horticultural Crops and their Management	1:0:1
31	18HO2024	Apiculture, Sericulture and Lac Culture	1:0:1
32	18HO2025	Study tour - II	0:0:1
Agricultural Engineering			
1	18AT2001	Fluid Mechanics and Open Channel Hydraulics	3:0:1
2	18AT2002	Engineering Properties of Biological Materials and Food Quality	2:0:0
3	18AT2003	Post-Harvest Engineering of Cereals, Pulses and oilseeds	2:0:0
4	18AT2004	Farm Machinery and Equipment-I	2:0:1
5	18AT2005	Tractor Systems and Controls	2:0:0
6	18AT2006	Farm Machinery and Equipment-II	2:0:1
7	18AT2007	Field Operation and Maintenance of Tractors and Farm Machinery	0:0:2
8	18AT2008	Post-Harvest Engineering of Horticultural Crops	2:0:0
9	18AT2009	Soil and Water Conservation Engineering	2:0:1
10	18AT2010	Fundamentals of Renewable Energy Sources	2:0:0
11	18AT2011	Extension Methodology and Transfer of Technology	2:0:0
12	18AT2012	Dairy and Food Engineering	2:0:1
13	18AT2013	Storage Structures and Packaging Technology	2:0:1
14	18AT2014	Agricultural Waste and By-products utilization	2:0:0
15	18AT2015	Ground water, Wells and Pumps	2:0:1
16	18AT2016	Water Harvesting and Soil Conservation Structures	2:0:1
17	18AT2017	Bio Energy Systems: Design and Applications	2:0:1
18	18AT2018	Irrigation and Drainage Engineering	2:0:1
19	18AT2019	Micro Irrigation	2:0:1
20	18AT2020	Process Engineering for Spices and Plantation Crops	2:0:0
21	18AT2021	Application of RS and GIS in Agriculture	2:0:0
22	18AT2022	Process Equipment Design	2:0:0
23	18AT2023	Development of Processed Products	2:0:0
24	18AT2024	Farm Machinery Design and Production	2:0:0
25	18AT2025	Tractor Design and Testing	2:0:0
26	18AT2026	Mechanics of Tillage and Traction	2:0:0
27	18AT2027	Ergonomics, Human Engineering and Safety in Agricultural Machinery	2:0:0
28	18AT2028	Drip and Sprinkler Irrigation-Design and Installation	0:0:10
29	18AT2029	Watershed Management-Concept and Strategies	0:0:10
30	18AT2030	Precision Farming in the Semi-arid and Humid Tropical Zones	0:0:10
31	18AT2031	Minor Irrigation and Command Area Development	0:0:10
32	18AT2032	Landscape Irrigation Design and Management	0:0:10
33	18AT2033	Agro-Industry Design and Management	0:0:10
34	18AT2034	Farm Machinery and Power	1:0:1
35	18AT2035	Soil and Water Conservation	1:0:1
36	18AT2036	Skill Development Training-I (Student READY)	0:0:5
37	18AT2037	10-Weeks Industrial Attachment/Internship(Student READY)	0:0:10
38	18AT2038	10-Weeks Experiential Learning On campus (Student READY)	0:0:10

39	18AT2039	Skill Development Training-II (Student READY)	0:0:5
40	18AT2040	Educational Tour	0:0:2
41	18AT2041	Project Planning and Report Writing	0:0:10
42	18AT2042	Renewable Energy and Green Technology	1:0:1
43	18AT2043	Protected Cultivation and Secondary Agriculture	1:0:1
44	18AT2044	Water Quality and Management Measures	2:0:0
45	18AT2045	Basics of MATLAB Programming	2:0:0
46	18AT2046	Farm Mechanization – Field Study	0:0:10
47	18AT2047	Testing of Farm Machinery and Equipments	0:0:10
48	18AT2048	Value Addition of Indigenous Fruits and Vegetables	0:0:10

18AG1001 FUNDAMENTALS OF AGRONOMY

Credits : 3:0:1

Course objectives

- To have a general understanding of the Agronomy, seasons, crop and its classification
- To appraise the students about crops, planting/sowing, growth and factors influencing growth and crop nutrition and its general management
- To study the impact of weeds on crop production and its management

Course outcomes

- Basics of crop characteristics and its classifications understood
- Fundamentals of growth, factors influencing and its relationship with nutrients studied
- Scientific knowledge on weeds its impacts on crop growth and the Integrated weed management studied

Theory

Agronomy and its scope, seeds and sowing, tillage and tilling, crop density and geometry, crop and its classifications, Crop nutrition, manures and fertilizers, nutrient use efficiency, Weeds- importance, classification, crop weed competition, concepts of weed management, principles and methods, herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agro-climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements- reversible plough, one way plough, harrow, leveler, seed drill.

References

1. Chandrasekaran. B, Annadurai. K and Somasundaram. E. A textbook of agronomy 2010 reprint 2016. New international (P) limited, publishers, New delhi
2. Reddy. T.Y and Reddy, G.H.S.1995. Principles of Agronomy, Kalyani Publishers, Ludhiana.
3. Balasubramanian, P and Palaniappan, S.P. 2001. Principles and Practices of Agronomy. AgroBios (India) Ltd., Jodhpur.
4. De, G.C.1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi.
5. Gupta, O.P. 2000. Weed Management - Principles and Practices. Agrobios (India) Ltd., Jodhpur
6. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7th ed.). Pearson Education, Delhi.
7. Rao, V.S. 2000. Principles of Weed science. Oxford & IBH Publishing Co. NewDelhi.
8. Sankaran, S. and Subbiah Mudaliar, V.T. 1991.Principles of Agronomy. Bangalore, Printing & Publishing Co., Bangalore

18AG1002 AGRICULTURAL HERITAGE

Credits : 1:0:0

Course objectives

- To have a general understanding of importance of the agriculture and agriculture resources in India
- To study the agriculture heritage of India from ancient to modern period
- To study the indigenous traditional knowledge in agriculture and the crop voyage in India and the world
- To study the gender perspective and task of farm women and women's empowerment and self-help groups

Course outcomes

- Studied the agriculture resources and development of agriculture in India from ancient to modern period
- Indigenous traditional knowledge (ITK) and its uses in agriculture learned
- Gained knowledge on gender issues in agriculture, women empowerment and self help groups

Theory

Agriculture scope; Importance of agriculture and agricultural resources available in India; Origin of agriculture- branches of agriculture- agricultural systems in the world-Crop significance and classifications; Green revolution and its impact- National agriculture setup in India; ICAR and SAUs- Current scenario of Indian agriculture; Indian agricultural concerns and future prospects-CGAIR and international institutions. Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Natural calamities and famines- Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Introduction to gender perspectives in agriculture- gender concepts- multiples roles of women- Women in agriculture- multifaceted roles and tasks of farm women- gender, poverty and livelihoods. Gender equity and strategies for rural women's empowerment- self- help groups. Farm mechanization and women- Occupational health hazards- Women friendly agricultural technology- Ergonomical approaches- Technological options

References

1. Randhawa, M.S. 1980-1986. A History of Agriculture in India Vol. I to IV Indian Council of Agricultural Research, New Delhi.
2. Ahmed, S. 2004. Gender Issues in Agricultural and Rural Livelihoods-Vol. I M.S. Swaminathan Research Foundation, Chennai and Kerala Agricultural University, Thrissur.
3. Commonwealth Secretariat.1996. Women and Natural Resource Management: A Manual for the Asian Region. Gender and Youth Affairs Division, London.
4. Noor Mohammed.1992. Origin, diffusion and development of agriculture. In: Noor Mohammed (ed.), New Dimensions in Agricultural Geography: Vol.1.Historical Dimensionsof agriculture. Concept publishing Co., New Delhi. Pp 29-75.
5. Handbook of agriculture, 2012, ICAR, New Delhi

18AG1003 INTRODUCTORY AGRICULTURAL METEOROLOGY AND CLIMATE CHANGE

Credits : 1:0:1

Course Objectives:

- To understand the role of agricultural meteorology in crop production
- To learn climatic factors and their measurements
- To study the fundamentals of climate change

- To provide knowledge on the effect of climate change on crop production

Course Outcome:

- Agro-climatic factors understood
- Measurement and estimation techniques for climatic parameters learned
- Fundamentals of climate change studied
- Effect of climate change on crop production understood

Theory

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

References

1. Prasada Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Second Edition. Kerala Agricultural University, Thrissur
2. Varshneya, M.C. and Balakrishna Pillai, B. 2003. Textbook of Agricultural Meteorology. ICAR, New Delhi
3. Venketaraman, S. and Krishnan, A. 1992. Crops and weather. ICAR, New Delhi
4. Sachati, A.K. 1985. Agricultural Meteorology — Instruction-cum-practical manual, NCERT, New Delhi
5. Mavi, HS, 1986. Introduction of Agrometeorology. Oxford & IBH Publishing Co. New Delhi

18AG1004 FUNDAMENTALS OF PLANT BIOCHEMISTRY

Credits : 2:0:1

Course Objectives:

- The students will know, why the broad spectrum of biochemistry is important in medicine, agriculture, pharmaceuticals, and ethics;
- To educate on the importance of Biomolecules with structure classification and function.
- To understand about the generation and storage of metabolic energy

Course Outcome:

- Knowledge about developments in biochemistry Cell structure, water and major molecules of life.
- Understand overall aspects of the integration of metabolic processes;
- Basics of carbohydrates proteins enzymes vitamins nucleic acids minerals and lipids will be understood

Theory

A brief introduction to developments in biochemistry and its transformation to molecular biology. Cell structure, water and major molecules of life. Carbohydrate chemistry: structure, classification, functions (mono, di and polysaccharides) isomerism and mutarotation. Metabolism of carbohydrates: glycolysis, gluconeogenesis, glycogenolysis, glycogenesis, TCA cycle, central role of TCA cycle in metabolism. Protein chemistry: classifications and functions. Classification, structure, function and properties of amino acids. Essential and non-essential amino acids. Primary, secondary, tertiary and quaternary structure of proteins. Amphoteric property. Biuret reaction and xanthoproteic reaction. Digestion and absorption of proteins. Classification, structure, functions and properties of lipids. Essential fatty acids and phospholipids. Digestion and absorption of lipids. Lipid auto oxidation. Significance of Omega-3 and Omega-6 fatty acids. Enzymes: nomenclature; classification; specificity; mechanism of enzyme action; kinetics and regulation of enzyme activity. Steroid and peptide hormones- chemistry and function. Structure and functions of fat and water soluble vitamins. Vitamins – classification- functions. Minerals – classification – functions. Nucleic acids: Structure function and importance genetic code. Transcription and translation. Protein synthesis. Energy changes in chemical reactions, reversible and irreversible reactions in metabolism.

Practical

Preparation of normal solution of acid and base, buffers and reagents. Qualitative determination of carbohydrates, proteins and lipids. Estimation of total nitrogen and total protein. Estimation of carbohydrates in foods. Determination of specific gravity of oil. Extraction and estimation of total lipids in seeds. Determination of saponification value, iodine value and free fatty acid value.

References

1. Jain, L. 2001. Fundamentals of Biochemistry, 5th Edition, S. Chand & company, New Delhi.
2. Lehninger, A. 1984. Principles of Biochemistry, Published by CBS publishers and Distributors, New Delhi.
3. Thayumanavan. B, Krishnaveni S, Parvathi K. Biochemistry for Agricultural Sciences, Galgotia Publications, New Delhi.
4. Verma, S.K. 2000 A Text Book of Plant Physiology and Biochemistry, S .Chand & company, New Delhi-110055.

18AG1005 AGRICULTURAL MICROBIOLOGY**Credits : 2:0:1****Course Objectives:**

- To learn about the structure of microbes.
- To have a general understanding on soil microbiology.
- To study the beneficial use of microorganisms.

Course Outcomes:

- Structure of microbes studied.
- Action of microbes in soils understood.
- Beneficial use of microbes learned.

Theory

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination transformation,

conjugation and transduction, plasmids, transposon. Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

Practical

- Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture.
- Methods of sterilization.
- Nutritional media and their preparations.
- Enumeration of microbial population in soil- bacteria, fungi, actinomycetes.
- Methods of isolation and purification of microbial cultures.
- Isolation of *Rhizobium* from legume root nodule.
- Isolation of *Azotobacter* from soil.
- Isolation of *Azospirillum* from roots. Isolation of BGA.
- Staining and microscopic examination of microbes.

References

1. Alexander, M. 1985. Introduction to Soil Microbiology .John Wiley & Sons , New York.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
3. Stanier ,R.Y., Ingraham, Wheelis ,M.G. and Paintor ,P.R. 1986. The Microbiology World. Prentice Hall, New Jersey.
4. Subba Rao, N.S. 1999 .Biofertilizers in Agricultural and Agroforestry .Oxford & IBH New Delhi
5. <http://www.agrimoon.com/agriculture-icar-ecourse-pdf-book/> TNAU (ICAR)

18AG1006 RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY

Credits : 2:0:0

Course objectives

- To get an idea of sociological behaviour of rural population
- To familiarize the functions of rural society social stratification and social changes
- To understand the behaviour pattern and theories of motivation

Course outcomes

- Students learnt the rural society and their behaviour pattern
- Students gained the practical knowledge of functions of social institution
- Familiarize the concept of agricultural extension practices

Theory

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

References

1. Desai, A.R. 2003. *Rural sociology in India*. Popular Prakashan, Bombay.
2. Partha Sarathi De., 2012. *Rural Sociology*. Pearson Education, New Delhi
3. Samanta, R.K. and Arora, S.K. (Eds) . 1997. *An introduction to Sociology*. Kitab Mahal. S.D., Pvt. Ltd. Allahabad

18AG1007 IRRIGATION WATER MANAGEMENT

Credits : 1:0:1

Course objectives

- To understand the water resources of the country and state
- To study the soil water plant relationship and soil moisture constant
- To introduce the concept of water requirement of crops and irrigation management

Course outcomes

- Students learnt the estimation of the irrigation requirement by various methods
- Students gained the practical knowledge of implementation of surface, pressurized and micro irrigation
- Familiarize the concept of water productivity and principles of drainage

Theory

Irrigation: definition and objectives. Role of water in soil and plants-Water resources and irrigation development in India and Tamil Nadu. Soil-plant-water-relationships. Soil moisture constants. Evapotranspiration, potential evapo-transpiration and consumptive use, Reference crop evapotranspiration (ET_o)- Crop co-efficient (K_c)- K_c values for different crops. Main empirical methods of calculation of ET_o- Effective rainfall, Water requirement of crops- Factors affecting water requirement of crops- Methods of determining water requirement-effective rainfall- Scheduling irrigation based on various approaches – Methods of irrigation. Surface, subsurface, overhead and micro irrigations including sprinkler, drip and bubbler irrigation. Irrigation efficiency- Water productivity and water use efficiency- Agronomic techniques to improve water productivity- Conjunctive use of water- irrigation water quality criteria and its management. Water management of principal crops of Tamil Nadu. Agricultural drainage-causes of water logging and types of drainage.

Practical

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Operation of sprinkler, drip and common micro irrigation systems; Visit to a water management research station

References

1. Michael, A.M. 2007. Irrigation Theory and Practice (2nd Ed.). Vikas Publishing House Pvt.Ltd., New Delhi.
2. SankaraReddi, G.H. and Yellamananda Reddy, T. 2003. Efficient Use of Irrigation Water. Kalyani Publishers, Ludhiana.
3. Lenka, D. 2005. Irrigation and Drainage (3rd Ed.). Kalyani Publishers, Ludhiana.

18AG1008 PRINCIPLES OF GENETICS AND CYTOGENETICS

Credits: 2:0:1

Course Objectives:

- To study mendelian concepts of heredity
- To impart knowledge on linkage and crossing over
- To make the student understand gene structure and function
- To study about genetic disorders

Course Outcome:

- Students will understand the concept of Mendelian principles
- Overview of Linkage and crossing over
- Understand the Gene structure and function

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in *Drosophila*. Study of models on DNA and RNA structures.

References

1. Gardner, J., Simmons, M. J. and Snustad, D. P. 2009. Principles of Genetics (8th Ed.). Wiley India Pvt. Ltd., New Delhi.
2. Gupta, P.K. 1999. Cytogenetics. Rastogi Publishers, Meerut.
3. Singh, B.D. 2000. Fundamentals of Genetics (6th Ed.). Kalyani Publishers, Ludhiana
4. Singh, P. 1995. Elements of Genetics. Kalyani Publishers, Ludhiana.
5. <http://www.agrimoon.com/agriculture-icar-ecourse-pdf-book/> TNAU (ICAR)

18AG1009 FUNDAMENTALS OF CROP PHYSIOLOGY

Credits : 2:0:1

Course Objectives:

- To introduce the students to crop physiology and biochemical changes during crop development.
- To impart knowledge on transport system in plants, photosynthesis and respiration
- To understand growth and growth characteristics

Course Outcome:

- Knowledge gained on different aspects of crop physiology.
- Learned detailed understanding of the physiological mechanisms involved in the uptake and transport of water and the translocation of food by plants.
- Study growth pattern of plants and growth parameters in crop production.

Theory

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).

References

1. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand& Company Ltd., New Delhi.
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3. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
4. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

18AG1010 FUNDAMENTALS OF PLANT PATHOLOGY

Credits : 2:0:1

Course Objectives:

- To impart knowledge on plant diseases and plant pathogens
- To make the student understand the classification and life cycle of plant pathogens
- To learn basics of plant disease management

Course Outcome:

- Able to know and differentiate different plant pathogens and disease caused by them
- Knowledge on pathogen characteristics, reproduction, resting structures and transmission will be imparted
- Chemical nature, mode of action of different fungicide, Physical and bio-control measures will be studied

Theory

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes. Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes. Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.) Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipments and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

References

1. Agrios, G.N. 2005. Plant Pathology. (5 th Ed.). Elsevier Academic Press. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2014. Introductory Mycology (4thEd.). Wiley India Pvt Ltd. Jayaraman, J. and Verma, J. P. 2002. Fundamentals of Plant Bacteriology (Reprint, 2015). Kalyani publishers, New Delhi
2. Ravichandra, N.G. 2013. Fundamentals of Plant Pathology. PHILearning Pvt Ltd. 639p.
3. Walkey, D. G. 1991. Applied Plant Virology (2nd Ed.). Springer.
4. Webster, J. and Weber, R. W. S. 2007. Introduction to Fungi. (3 rd Ed.). Cambridge University press.
5. Thorne, G. 1971. Principles of Nematology, McGraw Hill Book Co., New York, London.

18AG1011 FUNDAMENTALS OF ENTOMOLOGY

Credits : 2:0:1

Course Objectives:

- To impart knowledge on morphology, anatomy and physiology of insects
- To make the student understand insect ecology and different IPM techniques
- To learn the insect systematics

Course Outcome:

- Insect body parts, organ systems - their structure, functions and modifications will be understood
- Knowledge on factors influencing pest occurrence and different (physical, chemical and biological) control measures will be gained
- Orders and families of Agricultural importance pests and their characteristics will be studied

Theory

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control importance, hazards and limitations. Recent methods of pest control, repellents, anti feed ants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

References

1. Gullan, P. J. and Cranston, P. S. 2014. The insects: an outline of entomology. (8th Ed.) Wiley Blackwell
2. Metcalf, C. L. and Flint, W. P. 1973. Destructive and Useful Insects. Tata Mc Graw Hill Publishing Co. New Delhi.
3. Nair, K. K., Ananthkrishnan, T. N. and David, B. V. 1979. General and Applied Entomology. Tata Mc Graw Hill Publishing Co. New Delhi.
4. Naumann, I. D. 1991. The Insects of Australia a text book of students and research workers Vol. I & II (2nd Ed.) Commonwealth Scientific and Industrial Research Organisation. Melbourne University Press.
5. Pant, N. C. and Ghai, S. 1973. Insects Physiology and Anatomy. I CAR. New Delhi, 332 p. 6. Richards, O. W. and Davies, R. G. 1977. Imms General Textbook of Entomology Vol. I Chapman and Hall, London.
6. Richards, O. W. and Davies, R. G. 1977. Imms General Textbook of Entomology. Vol. II Chapman and Hall, London.
7. Snodgrass, R. E. 1935. Principles of Insect Morphology. Tata Mc Graw Hill Publishing Co. New Delhi.

18AG1012 FUNDAMENTALS OF AGRICULTURAL ECONOMICS

Credits : 2:0:0

Course objectives

- To orient the students about the principles of economics and to get an idea of macro and micro economics
- To expose the basic theories of economics
- To understand the concept of agricultural economics and its relation with other subjects

Course outcomes

- Students learnt the concept of basic economic theories
- Familiarize the function of market and its impact on agricultural production

- Gained knowledge on agricultural finance and the role of banks and other credit agencies

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. *Demand:* meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. *Laws of returns:* Law of variable proportions and law of returns to scale. *Cost:* concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. *National income:* Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax:* meaning, direct and indirect taxes, agricultural taxation, GST. *Economic systems:* Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

References

1. Dewett, K.K. 2005. Modern Economic Theory. S. Chand, New Delhi.
2. Dewett, K.K. and Verma. 2004. Elementary Economic Theory, S.Chand, New Delhi
3. Jhingam, M.L. 2001. Micro Economic Theory. Konark publishers, New Delhi
4. Reddy, S., Raghuram, P., Neelakantan, T.V. and Bhavani D. I. 2004. Agricultural Economics. Oxford and IBH Publishers, New Delhi.

18AG1013 FUNDAMENTALS OF SOIL SCIENCE

Credits : 2:0:1

Course Objectives:

- To impart knowledge about the soil forming process.
- To learn about physical properties of soil.
- To have a general understanding on soil chemical properties reactions.
- To study the impacts of soil pollution and the remediation measures.

Course Outcomes:

- Knowledge gained about the soil forming process.
- Physical properties of soil studied.
- Various soil chemical properties and reactions understood.
- Impact of soil pollution and remediation measures learnt.

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids- inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

References

1. Biswas, T.D. and Mukherjee, S.K. 1987. Text Book of Soil Science. Tata McGraw Hill Publishing Co., New Delhi
2. Black, C.A. 1982. Methods of Soil Analysis, Part I ASA, Madison, USA.
3. Brady, N.C. 1990 Nature and Properties of Soils. 10th Edn, Macmillan Publishing Co. Inc., New York
4. Das, D.K. 1997. Introductory Soil Science. Kalyani Publishers New Delhi

18AG1014 FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION

Credits : 2:0:1

Course Objective:

- The course is intended to orient the students with the concept of extension education and its importance in Agriculture development
- To expose the students with various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis
- To make the students learn about the new innovations being brought into the Agricultural Extension in India
- To learn about the new trends in agriculture extension

Course Outcome:

- Students learned the concepts of agricultural extension and rural development programs.
- New innovations in the area of agricultural extension in India understood
- Gained practical knowledge on watershed development and self-help groups
- New trends in agriculture extension learned

Theory

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and

post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc. Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

References

1. De, Dipak. 2011. *A handbook of Extension education*. JV Publishing House, Jodhpur
2. Van Den Ban, A.W. and Hawkins, H.S. 1998. *Agricultural Extension* (2nd Ed). New Delhi, CBS Publishers and Distributors.
3. Vasanth Kumar, J. 2007. *New Dimensions and approaches in Extension Pluralism for Rural Development*. J.V. Publishing House, Jodhpur.
4. www.planning commission.nic.in
5. www.agricoop.nic.in
6. www.rural.nic.in

18AG1015 INTRODUCTION TO AGRICULTURE AND HORTICULTURE

Credits 2:0:0

Course Objectives:

- To introduce the scope of agriculture to engineering students
- To impart knowledge on soil-water-plant relationship
- To familiarize with plant growth and fertilizer application and irrigation

Course Outcome:

- Basics of agriculture science learned
- Soil-water-plant relationship learned
- Different stages of plant growth and application of fertilizers studied

Theory

Orientation to agriculture and agricultural engineering. Soils: Nature and origin of soil; soil forming rocks and minerals, soil forming processes, important soil physical properties and their importance. Ion

exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility. Soil reaction – acid, saline and sodic soils. Agronomy: Definition and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tillage and its characteristics. Soil water plant relationship and water requirement of crops. Soil fertility and its management, integrated nutrient management. Bio-fertilizers and vermicomposting. Weeds and their control, integrated weed management. Crop rotation, cropping systems, relay cropping and mixed cropping. Sustainable agriculture, integrated farming system, precision farming, organic farming and good agricultural practices. Horticulture: Scope and Importance of horticultural and vegetable crops - Divisions - Soil and climatic requirements for fruits, vegetables and floriculture crops, Criteria for site selection, layout, planting methods in orchard establishment - Nursery raising - Macro propagation, Micro propagation methods and its applications in horticulture - Plant growing structures and Special horticultural practices- Fertilizer application, fertigation and irrigation methods- Garden tools and management of orchard - Extraction and storage of vegetables seeds.

Reference books

1. Sharma, Rakesh Kumar et. Al., Basics of Agriculture for Engineers, Daya Publishing House, 2014
2. Gajendra Singh Tomar, Agronomy: Basic and Applied, Satish Serial Publishing House, 2010
3. Bose, T.K and S.K. Mitra. 1990. Fruits, Tropical and Subtropical. Naya Prakash, 206 Bidhan saran, Calcutta.
4. Brady, Nyle C. 1988. The nature and properties of Soils. Eurasia Publishing House Pvt Ltd, New Delhi.
5. Das, P.C. 1993. Vegetable Crops of India. Kalyani Publishers, New Delhi.
6. De, G.C. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co Pvt Ltd, NewDelhi.

18AG1016 INTRODUCTORY AGRO FORESTRY

Credits : 1:0:1

Course objectives

- To study the importance of forest and agroforestry systems in sustaining the land productivity
- To understand the crop tree interactions in different types of agroforestry systems
- To get an idea of the productive and protective functions of agroforestry

Course outcome

- Students learnt about the concepts of agroforestry practiced in various agro ecosystems
- Basic understanding of the multipurpose trees in agroforestry systems
- Beneficial effects of agro forestry such as nitrogen fixing, soil conservation, litter dynamics and nutrient cycles will be studied

Theory

Introduction – definitions of basic terms related to forestry, importance and objectives of silviculture, types of forests-salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations- tree stand management. Agroforestry – definition and concepts Agroforestry systems and practices- different agroforestry systems prevalent in the country and Tamil Nadu, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, plantation crop combinations, home gardens. Multi purpose trees in agroforestry, characteristics- Under storey components and diversification potentials- Component interactions- above ground and below ground interactions. Productive and protective functions- Nitrogen fixation- Soil conservation- Litter dynamics and nutrient cycling – Carbon

sequestration and climate change mitigation - Social forestry- concept and importance, practices in different agro ecosystems

Practical

Identification of tree-species. Diameter measurements using calipers and tape. Height measurement of standing trees by shadow method, single pole method and hypsometer. Nursery lay out, seed sowing, vegetative propagation techniques. Different agroforestry systems like sAgrosilvicultural systems, Silvopastoral systems, Agrosilvopastoral systems and their interactions

References

1. Puri, S and Panwar, P. (ed.). 2007. Agroforestry Systems and Practices. New India Publishing Agency, New Delhi, 643p
2. Gupta, R.K. 1993. Multipurpose Trees for Agroforestry and Wasteland Utilization. Oxford and IBH, 562p
3. Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwere Academic Publications, Dordrecht, The Netherlands, 499p

18AG1017 WEED MANAGEMENT

Credits : 1:0:1

Course Objectives:

- To identify the weed species present in different agro ecosystems
- To study the different weed control methods
- Learn about herbicides and its formulations and integrated weed management

Course Outcomes:

- Students will familiarised about the weed species and weed classification
- Different weed control methods and management will be studied.
- Different herbicides and its formulations and integrated weed management will be understood.

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non-chemical methods of weed management. Herbicide Resistance and its management.

Practical

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

References

1. Jaganathan, R. and R. Jayakumar. 2003. Weed Science Principles, Kalyani Publishers, New Delhi.
2. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
3. Rao, V.S. 2000. Principles of Weed science. Oxford & IBH Publishing Co. New Delhi.

18AG1018 PRODUCTION TECHNOLOGY FOR VEGETABLE, FRUIT AND PLANTATION CROPS

Credits: 2:0:1

Course Objective:

1. To impart knowledge on basic cultural practices of Vegetables, Fruits and Plantation Crops.
2. To insist on modern techniques to increase the yield and production.
3. To learn about the economic estimation of commercial Horticultural crops.

Course Outcome:

1. The student gains a thorough knowledge on basic production technology.
2. Familiarize on basic pruning and training techniques of fruits and plantation crops.
3. Acquaintance on commercial oriented cultural practices.

Theory

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield, post-harvest handling, economics and marketing of tropical and subtropical vegetable crops such as tomato, brinjal, chillies, capsicum, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca, basella, sorrel and roselle. Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, grapes, citrus, papaya, sapota, guava, pomegranate, bael, ber, amla, anona, fig, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian, rambutan, bilimbi, loquat, rose apple breadfruit and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production. History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micropropagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut, oil palm, palmyrah palm, cacao, cashew nut, coffee, tea, Date palm and rubber.

Practical

Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and intercultural; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation. Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. Selection of site and planting system, pre-treatment of banana suckers, desuckering in banana, sex forms in papaya. Use of plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops, preparation

and application of growth regulators in banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annona. Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens, manuring, irrigation; mulching, raising masonry nursery for palm, nursery management in cacao. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea.

References

1. S. Thamburaj, 2014. Text book of vegetable, tuber crops and Spices. ICAR, New Delhi
2. B.R.Choudhary, 2009. A Text book on production technology of vegetables. Kalyani Publishers. Ludhiana.
3. T.K.Bose, 2002. Vegetable Crops. Nayaprakash. Kolkata..
4. M.S.Ladaniya, 2013. Citrus Fruits. Elsevier, India post ltd.
5. Bose, T.K., Mitra, S.K. and Sanyal, D., 2002. Tropical and Sub-Tropical-Vol-I. Nayaudyog-Kolkata
6. Chundawat, B.S., 1990. Arid fruit culture. Oxford and IBH, New Delhi.
7. Chadha, K.L. (ICAR) 2002, 2001. Hand book of Horticulture. ICAR, New Delhi.
8. Symmonds, 1996. Banana. II Edn. Longman, London.
9. Radha T and Mathew L., 2007. Fruit crops. New India Publishing Agency.
10. W S Dhillon, 2013. Fruit Production in India. Narendra Publishing House, New Delhi

18AG2001 PRINCIPLES OF PLANT BREEDING

Credits : 2:0:1

Course Objectives:

- To impart knowledge on genetic diversity, inheritance and variation in crops
- To make the student understand different breeding methods in asexually propagated, self and cross pollinated crops
- To learn IPR, patenting, Plant Breeders and Farmers Rights

Course Outcome:

- Origin and diversity of different crops, components of inheritance and variations will be understood
- Students will be able to apply different breeding techniques for crop improvement
- Gain knowledge on IPR, patenting, Plant Breeders and Farmers Rights followed

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and

hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and prebreeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids.

Reference books

1. Acquaah, G. 2007. Principles of Plant Genetics & Breeding. Blackwell Publishing Co., New Delhi.
2. Allard, R.W. 1981. Principles of Plant Breeding. John Wiley & Sons, New York.
3. Chopra, V. L. 2004. Plant Breeding. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Gupta, S. K. 2005. Practical Plant Breeding. Agribios, Jodhpur.
5. Roy, D. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publishing House Pvt. Ltd., New Delhi.
6. Sharma, J. R. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill Publishing Co. Pvt. Ltd., New Delhi.
7. Simmonds, N.W. and Smartt, J. 2014. Principles of Crop Improvement. Wiley India Pvt. Ltd., New Delhi.
8. Singh, B. D. 2014. Plant Breeding - Principles and Methods. Kalyani Publishers, Ludhiana.
9. Singh, P. 2002. Objective Genetics and Plant Breeding. Kalyani Publishers, Ludhiana.
10. Singh, P. 2006. Essentials of Plant Breeding. Kalyani Publishers, Ludhiana.
11. Singh, P. and Narayanam, S. S. 2009. Biometrical Techniques in Plant Breeding (4th Ed.). Kalyani Publishers, Ludhiana.
12. Singh, S. and Pawar, I. S. 2006. Genetic Bases and Methods of Plant Breeding. CBS Publishers, New Delhi.

18AG2002 CROP PRODUCTION TECHNOLOGY - I (KHARIF CROPS)

Credits : 1:0:1

Course Objectives:

- To provide foundational understanding of kharif crop production
- To learn the economic importance of kharif crops
- To provide knowledge on cultural practices of kharif crops

Course Outcome:

- Economic importance of kharif crops understood
- Basic management for kharif crops production learned
- Cultural practices for crop production studied

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops. Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-

pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops.

Reference

1. Prasad, R. (ed.). 2001. *Field Crop Production*. ICAR, New Delhi
2. Pal, M., Deka, J. and Rai, R.K. 1996. *Fundamentals of Cereal Crop Production*. Tata McGraw Hill Pub., New Delhi
3. Singh, C., Singh, P., and Singh, R. 2003. *Modern Techniques of Raising Field Crops* (2nd ed.). Oxford & IBH, New Delhi.

18AG2003 AGRICULTURAL FINANCE AND COOPERATION

Credits : 2:0:1

Course objectives

- To get an idea of credit needs and its role in Indian agriculture
- To familiarize the sources of agriculture finance
- To learn the cooperative movement its principles and its significance in agricultural community

Course outcome

- Students learn the functions of banks and types of banks, role of RBI and NABARD in agricultural finance
- Students learn the credit availability and functions of different types of cooperative societies in the state
- Basic understanding of financial statements, balance sheets and income statements

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent developments in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

Practical

Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study.

Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products.

References

1. Reddy, S. and Ram, P.R.2005. *Agricultural Finance and Management*.Oxford and IBH, Publishers, New Delhi.
2. Reddy, S., Raghuram, P., Neelakantan,T.V and Bhavani, D.I. 2004. *Agricultural Economics*. Oxford and IBH Publishers, New Delhi.
3. RBI: <https://www.rbi.org.in>
4. NABARD: <https://www.nabard.org>
5. World Bank: <http://www.worldbank.org>
6. ADB: <http://www.adb.org>
7. Lead Bank: <http://www.canarabank.com>

18AG2005 LIVESTOCK AND POULTRY MANAGEMENT

Credits 3:0:1

Course objectives

- To understand the importance of farm animals
- To study characters of indigenous and exotic breeds of cattle, goat, buffalo, swine and poultry
- To study the management of farm animals, its nutrient requirement and its housing

Course outcome

- Understood the importance of farm animals and its influence in rural economy
- Gained knowledge on characteristics of indigenous and exotic breeds of cattle, goat, buffalo, swine and poultry
- Practical knowledge on management of farm animals, its nutrient requirement and its housing

Theory

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Reference books

1. Banerjee, G.C. 2010. *The Text Book of Animal Husbandry*. Oxford Book Company, Calcutta.
2. Sastry, N.S.R., Thomas, C.K. 2005. *Livestock Production Management*. Kalyani Publishers, Ludhiana

3. Watson, J.A.S. and Mills, W.J. (2005). Farm animals and their Management.

18AG2008 CROP PRODUCTION TECHNOLOGY-II (RABI CROPS)

Credits : 1:0:1

Course Objectives:

- To provide foundational understanding of *Rabi* crop production
- To learn the economic importance of *Rabi* crops
- To study the basic management for *Rabi* crop production
- To provide knowledge on cultural practices of *Rabi* crops

Course Outcome:

- Economic importance of *Rabi* crops understood
- Basic management for *Rabi* crops production learnt
- Cultural practices for crop production studied

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane, identification of weeds in *rabiseason* crops, study of morphological characteristics of *rabicrops*, study of yield contributing characters of *rabiseason* crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of *rabicrops* at experimental farms. Study of *rabiforage* experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Reference

1. Das, P.C. 1997. Oilseed Crops of India, Kalyani Publishers., New Delhi
2. Yadav, D.S. 1992. Pulse Crops. Kalyani Publishers.,
3. Prasad, R. (ed.). 2001. Field Crop Production. ICAR, New Delhi
4. Balasuramaniyan, P. and Palaniappan, S.P. 2003. Principles and Practices of Agronomy. Agrobios(India)

18AG2009 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS AND LANDSCAPING

Credits: 1:0:1

Objective

- To educate students on production technology of cut flowers, ornamental crops and turf management.
- To study the Landscape use of trees, shrubs and climbers
- Exposing the students to different styles of landscape gardening.
- To know about harvesting and post-harvest handling of flower crops.

Outcomes:

- Familiarized with the production technology of cut flowers, ornamental crops and turf management.
- Landscape use of trees, shrubs and climbers were studied
- Learnt about the various styles of gardening.
- Got familiarized with the harvesting and post-harvest handling of flower crops.

Theory

Importance and scope of ornamental crops, cut flowers, foliage plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Various styles of gardening. Lawn establishment and maintenance. Landscaping designs for different environments. Package of practices for loose flowers like marigold and jasmine under open conditions. Package of practices for cut flowers like rose and carnation. Processing and value addition in ornamental crops.

Practical

Identification of Ornamental plants. Identification of foliage plants and cut flowers. Nursery bed preparation, seed sowing and transplanting. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of cut flowers. Lawn establishment and maintenance. Protected structures – care and maintenance. Intercultural operations in flowers and foliage plants. Harvesting and post harvest handling of cut and loose flowers. Visit to commercial flower and landscaping units.

References books:

1. G.S. Randhawa, 1998. Floriculture in India, Allied Publishers Pvt. Ltd., New Delhi
2. Desh Raj, 2014. Floriculture at a glance, Kalyani Publishers, New Delhi

18AG2011 PRINCIPLES OF SEED TECHNOLOGY

Credits : 1:0:1

Course objectives

- To learn about seed, grain and seed quality
- To introduce the concepts of seed certification, seed Act and seed test
- To have the knowledge about the foundation and certified seed production of cereals, pulses, oilseeds, fodder and vegetable crops

Course outcome

- Students learnt the seed production techniques
- Students enabled in identifying seed structure and morphology, physical characteristics of seed and biochemical tests
- Students capacitated in seed sampling, seed storage and seed marketing

Theory

Seed and seed technology: introduction, definition, its importance in increasing agricultural production. Difference between seed and grain and concept of seed quality. Deterioration causes of crop varieties and their control. Maintenance of genetic purity during seed production. Genetic and agronomic principles of seed production. Different classes of seed and truthfully labeled seed. Seed certification, phases of certification. Procedure for seed certification, field inspection. Foundation and certified seed production of important cereals (Rice, wheat and maize), pulses (Cowpea, mung, urd, pigeonpea, field bean and soybean), oilseeds (Sesame, coconut, sunflower, groundnut), fodder (Guinea grass, napier grass and lucern), and vegetables (Bhindi, tomato, brinjal, chillies and cucurbitaceous vegetables). Seed Act and Seed Act enforcement. Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983 and Seed Bill 2004 and other issues related to seed quality regulation. Varietal identification through electrophoresis and biochemical tests. Synthetic seeds and terminator gene technology. Detection of genetically modified crops. Transgene contamination in non-GM crops, GM crops and organic seed production. Physiological and harvestable maturity. Seed dormancy, internal and external factors affecting dormancy in seeds. Seed drying. Seed processing and their steps. Seed treatment, its importance, methods of application. Seed packing. Seed sampling and testing. Seed storage: general principles, stages and factors affecting seed longevity during storage.

Measures for pest and disease control during storage. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies. Participatory seed production and seed village concept

Practical

Varietal identification through seed structure and morphology, physical characteristics of seed and biochemical tests. Germination test in field and horticultural crops. Quick viability test of field and horticultural crops. Seedling vigour tests. Seed sampling principles and procedures; Physical purity analysis of field and horticultural crops. Genetic purity test: Grow out test and electrophoresis. Roguing, field inspection and preparation of field inspection report. Seed production in major cereals, pulses, oilseeds and vegetable crops. Visit to seed testing laboratories, farms and seed processing plants.

References

1. Khare and Bhale , 2014. Seed Technology, Scientific Publishers, New Delhi.
2. Sharma, J.P. 2011. Quality Seed Production of Vegetable Crops Technological Interventions, Volume 2: Crop Specific Aspect. Kalyani Publishers, Ludhiana.
3. Agrawal, P.K. and Dadlani, M. 1995. Techniques in seed science and technology. South Asian Publishers, New Delhi.
4. Agrawal, R.L. 1996. Seed Technology. Oxford & IBH Publication Co., New Delhi.

18AG2012 PROBLEMATIC SOILS AND THEIR MANAGEMENT

Credits : 2:0:0

Course Objectives:

- To learn about soil health quality and irrigation water quality parameters.
- To have a general understanding on reclamation and management of problem soils.
- To provide knowledge on Remote sensing, GIS and land use pattern.

Course Outcomes:

- Soil quality and irrigation water quality parameters learnt.
- Reclamation and management of problem soils understood.
- Remote sensing , GIS and bioremediation procedures studied.
- Land use pattern studied.

Theory

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

References

1. Donahu, L. R., Miller, W. R. and Shickuluna, 1977. Soils. Prentice Hall of India Pvt. Ltd., New Delhi Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI New Delhi, 2002
2. William F. Bleam Soil and Environmental Chemistry (Second Edition) UW Madison, Department of Soil Science, Madison, WI, United States. Elsevier Inc. (Available Online)
3. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. 1982. Saline Alkali Soils of India, ICAR, New Delhi.
4. Biswas, T.D. and Mukharjee, S.K. 2001. Text Book of Soil Science, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

18AG2013 AGRICULTURAL MARKETING, TRADE AND PRICES

Credits : 2:0:1

Course objectives

- To understand the concept of market structure and its classification
- To study the theories of demand and supply of agricultural produce in market oriented economy
- To learn the grading, packing, branding, labelling (AGMARK) of agricultural produce

Course outcomes

- Learnt the role of Government in agricultural marketing and price stability in agricultural produce
- General awareness of trade, present status of GATT, WTO, agreement on agriculture (AOA)
- Will be studying the role of public sector institutions namely CWC, SWC, FCI, CACP and DMI

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and Concept of risk and uncertainty in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources - Positive and negative externalities in agriculture. Inefficiency and welfare loss, solutions-Important issues in economics and management of common property resources of land, water, pasture and forest resources Farm inventory- Methods of valuation of farm assets- Depreciation- Meaning-Methods of computation of depreciation Classification of farming-Type of farming – Specialization, Diversification, Mixed farming, Dry farming and Ranching – Systems of farming -co-operative farming, Capitalistic farming, collective farming, State farming and Peasant farming determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; Marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Marketing Management-product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply Market curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some

selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

References

1. Philip, K. 2004. Marketing Management. Prentice Hall, New Delhi.
2. Philip, K. 2004. Principles of Marketing. Prentice Hall, New Delhi.
3. Acharya, S.S. and Agarwal, N.L.1994. Agricultural Prices and Policy. Oxford and IBH, New Delhi.
4. Alagumani ,T., Chinnaiyan, P. and Elangovan, S.1998. Agricultural Management . Publishers K9 International, Madurai.

18AG2014 INTRODUCTION TO BIOTECHNOLOGY

Credits : 1:0:1

Course Objectives:

- To expose the students to the basic scientific evidence and technical aspects of the different disciplines of biotechnology in agriculture (mainly for plants and crops).
- To understand the concepts and techniques in biotechnology
- Upon completion of this course the student should recognize the foundations of modern biotechnology and explain the principles that form the basis for recombinant DNA technology.

Course Outcome:

- Knowledge gained on different aspects of biotechnology
- Study the current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic
- Learned the general principles of generating transgenic plants, animals and microbes

Theory

Biotechnology: Introduction to Biotechnology –scope and importance in agriculture; Structural organization of prokaryotic and eukaryotic cell. Nucleic acids -structure, function and types, Concepts of gene and genetic code, transcription and translation, mutations and their implications. Post transcriptional modification and RNA processing. Gene regulation and expression in prokaryotes and eukaryotes; DNA sequencing, Operons. Genetic engineering-Restriction enzymes; Gene isolation; Cloning vectors; Probes; Recombinant DNA technology– vaccines. Transgenic plants and Gene transfer technology, Animal Cell Culture, Hybridoma technology. Molecular and immunological techniques – PCR; immunoblotting; ELISA; Principle of hybridization; Northern blotting; Western blotting; Southern blotting; DNA fingerprinting; Restriction fragment length polymorphism., Biosensors. Concept of bioremediation of water, bioprocess engineering and bioprospecting.

Practical

Study of structure of prokaryote and eukaryote Cells. Study on Model of protein Synthesis, Study of models rDNA Technology, Cell Culture, Isolation of Nucleic Acids, Restriction enzymes, Gel Electrophorus, ELISA, DNA sequence analysis and comparison.

References

1. Brown T A. 2002. Genomes 2. 2nd ed. New york:Wiley-Liss.
2. Prave P, Faust U &Sittig W. 1987. Fundamentals of Biotechnology. VCH Verlagsgesellschaft.
3. Chawla, H.S.2012. Introduction to plant biotechnology. IBH publishing Co.

4. Singh, B. D. 2013. Molecular biology, genetic engineering and applications of biotechnology. Kalyani Publishers.

18AG2015 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Credits : 2:0:1

Course Objectives:

- To know about the natural resources- Renewable and Non renewable
- To study about the Ecosystem, Biodiversity , Environmental pollution and conservation aspects
- To learn about the Natural and Man- made Disasters and their Management

Course Outcomes:

- Learnt about the natural resources- Renewable and Non renewable
- Studied about the Ecosystem, Biodiversity , Environmental pollution and conservation aspects
- Learnt about the Natural and Man- made Disasters and their Management

Theory

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) 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.

Ecosystems: Concept 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 following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical 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.

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. 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. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act.

Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare

Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

Disaster Management

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

Pollution case studies. Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

References

1. Ahluwalia, V.K and Malhotra, S. Environmental Science. 2006. Ane Books Pvt. Ltd. India
2. Banjerji, S.K. 1993. Environmental Chemistry. Prentice Hall of India Pvt. Ltd, New Delhi
3. Gupta, A.K. 2007. Methods in Environmental Analysis Water, Soil and Air. 2nd Edn. Published by AGROBIOS(India) Jodpur
4. Katyal, K. and Satake, M. 1990. Environmental Pollution. 2nd Edn. Anmol Publishers, New Delhi
5. Loomis, R.S and Corner, D.J. 1992. Crop Ecology, Productivity and Management in Agricultural Systems. Cambridge University Press Pandey, S.N and Misra, S.P. 2011 Environment and Ecology. Ane Books Pvt. Ltd. India

18AG2037 SPICES, MEDICINAL AND AROMATIC CROPS

Credits : 2:0:1

Course Objectives

- To teach scope and importance of Spices, medicinal and aromatic crops
- To impart knowledge on production technology of Spices, medicinal and aromatic plants
- To impart knowledge on various processes, essential oil and their uses of Spices, medicinal and aromatic plants

Course Outcome

- Scope and importance of Spices, medicinal and aromatic crops learnt
- Production technology of Spices, medicinal and aromatic plants studied
- Gain practical knowledge various processes, essential oil and their uses of Spices, medicinal and aromatic plants

Theory

History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements. Plant protection, harvesting and processing of under mentioned important medicinal and aromatic plants. Storage techniques of essential oils. Crops: Clove, Nutmeg, Cinnamon and Tamarind Origin and distribution – Area and production – Composition and uses – Soil and climate – varieties – propagation – planting – irrigation - nutrition management - weed control –

mulching - mixed cropping, intercropping, multi-tier cropping - cover cropping - training and pruning practices - role of growth regulators- harvest and yield- GAP –Organic production of Tree Spices- post harvest technologies – processing storage – value added products –organic production – constraintProduction technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Aromatic Plants: Citronella grass, lavender, geranium, patchouli, occimum and other species relevant to the local conditions. Processing and value addition in MAPs produce.

Practical

Collection of Spices, medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction of essential oils.

Text books

1. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil
2. Jitendra Singh. 2008. Spices and Plantation Crops. Aavishkar Publishers, Distributors, Jaipur.

18HO1001 FUNDAMENTALS OF HORTICULTURE

Credits 2:0:1

Course Objectives

- To study the basics of horticulture and horticultural practices
- To expose the students to different horticulture divisions
- To impart knowledge on different types of plant propagation and propagating structures

Course Outcome

- Basics of horticulture and classification of crops learned
- Different types of plant propagation techniques and propagating structures studied
- Gain practical knowledge in Special horticultural practices

Theory

Scope and importance, nutritive value - Classification of horticultural crops, Area, production, exports and imports, Agro-climatic zones of India - Nursery techniques and their management, Vegetable gardens, nutrition, kitchen garden and other types of gardens, Phases of growth and development - Factors affecting growth and development –Propagation of horticultural crops –Cutting and Layering - Grafting and Budding - Rootstock - scion relationships, Compatibility and incompatibility - Asexual propagation – Apomixis and Polyembryony - Orchard establishment - Principles, planning and layout of orchards - Planting systems and planting densities –Management of orchards – Intercultural operations, Principles objectives and types of pruning - training - Fruit set - carbon nitrogen relation, structure and process in relation to set and drop, factors affecting and measures to overcome drop - Bearing habit and Classification of bearing habits of fruit trees - Problems of unfruitfulness - internal factors, external factors – measures to overcome - Seedlessness in horticultural crops - significance and induction - Plant growth regulators - Water management– irrigation methods, merits and demerits - Weed management – Fertility management in horticultural crops-manures and fertilizers - Cropping systems, intercropping, multi-tier cropping - Rejuvenation of old orchards, top working and frame working - Production and practices for fruit, vegetable and floriculture crops - Principles of organic farming - Supply chain management.

Practical

Features of orchard, planning and layout of orchard, tools and implements, identification of various horticultural crops, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of

fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage, Visit to Private and Govt. nursery and orchard.

Text books

1. Jitendra Singh, 2004. Basic of horticulture. Kalyani publishers, Ludhiana.
2. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil, TamilNadu.

18HO1002 GROWTH AND DEVELOPMENT OF HORTICULTURAL CROPS

Credits 2:0:1

Course objectives

- To impart knowledge on basis of growth and development of horticultural crops
- To study the effects of factors responsible for physiological processes
- To learn physiological basis of horticultural practices

Course outcomes

- Gained knowledge on basis of growth and development of horticultural crops
- Students learnt the effects of factors responsible for physiological processes in horticultural crops
- Gained knowledge on physiological basis of horticultural practices

Theory

Growth and development-definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, Crop development and dynamics (Case studies of annual/perennial horticultural crops), growth analysis in horticultural crops. Plant bio-regulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering, photoperiodism-long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning-source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

Practical

Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, seed dormancy, seed germination and breaking seed dormancy with chemicals and growth regulators.

Text books

1. Zeiger. 2003.Plant Physiology. Panima. New Delhi.
2. Delvin, R.M . 1986. Plant Physiology. CBS. Delhi.
3. Edward E. Durna. 2014. Principles of Horticultural Physiology. CABI, UK.

18HO1003 PROPAGATION AND NURSERY MANAGEMENT FOR HORTICULTURAL CROPS

Credits 2:0:1

Course Objectives

- To impart skill oriented knowledge on media preparation and handling of tools for propagation
- To teach students on propagation methods
- To familiarize with the maintenance and after care of propagated plants

Course Outcome

- Students benefited with hands-on training in media preparation handling of tools for propagation
- Students learnt about mother plant selection and propagation techniques
- Students familiarized with the maintenance and after care of propagated plants

Theory

Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy types of dormancy (scarification & stratification) internal and external factors, nursery techniques nursery management, apomixes – monoembryony, Polyembryony, chimera & bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery (tools and implements), use of growth regulators in seed, types and stages of seed germination with examples and vegetative propagation, methods and techniques of division-stolons, pseudo-bulbs, offsets, runners, cutting, layering, grafting, formation of graft union, factor affecting, healing of graftage and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers. Micro-propagation – Micro-grafting, meristem culture, callus culture, anther culture, organogenesis, Somaclonal variation hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery.

Practical

Media for propagation of plants in nursery beds, potting and repotting. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, grafting and budding including opacity and grafting, top grafting and bridge grafting etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labelling and packing of nursery fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance. Nutrient and plant protection applications during nursery. Cost of establishment of propagation structures.

Text books

1. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 2006 Plant Propagation. Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
2. Prasad, S. and U. Kumar, 2005. Principle of Horticulture. 3rd edition, Agrobios, India.

18HO1004 PRODUCTION TECHNOLOGY OF TROPICAL AND SUBTROPICAL FRUITS

Credits 2:0:1

Course Objective:

- To impart knowledge on basic cultural practices of Tropical and Subtropical Fruitscrops
- To insist on modern techniques to increase the yield and production
- To learn about the special practices, harvesting and post-harvest handling of Tropical and Subtropical Fruits

Course Outcome:

- The student gains a thorough knowledge on basic production technology
- Familiarize on modern production techniques
- Acquaintance on special practices, harvesting and post-harvest handling

Theory

Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, banana, grapes, citrus, papaya, sapota, guava, pomegranate, bael, ber, amla, anona, fig, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian, rambutan, bilimbi, loquat, rose apple breadfruit and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production.

Practical

Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. Selection of site and planting system, pre-treatment of banana suckers, desuckering in banana, sex forms in papaya. Use of plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops, preparation and application of growth regulators in banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annona.

Text books

1. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. ed. by K.V. Peter, New India Publishing Agency, New Delhi.
2. H.P.Singh and M.M.Mustafa, 2009. Banana-new innovations. Westville PublishingHouse, New Delhi.
3. M.S.Ladaniya, 2013. Citrus Fruits. Elsevier, India post ltd.
4. Bose, T.K., Mitra, S.K. and Sanyal, D., 2002. Tropical and Sub-Tropical-Vol-I. Nayayudyog-Kolkata
5. Rajput, CBS and Srihari babu, R., 1985. Citriculture. Kalyani Publishers, New Delhi.
6. Chundawat, B.S., 1990. Arid fruit culture. Oxford and IBH, New Delhi.
7. Chadha,K.L. (ICAR) 2002, 2001. Hand book of Horticulture. ICAR, New Delhi.
8. Symmonds, 1996. Banana. II Edn. Longman, London.
9. Radha T and Mathew L., 2007. Fruit crops. New India Publishing Agency.
10. W S Dhillon, 2013. Fruit Productionin India. Narendra Publishing House, New Delhi
11. T.K.Chattopadhyay, 1997. Text book on pomology. Kalyani Publishers, New Delhi.

18HO1005 PRODUCTION TECHNOLOGY OF TROPICAL AND SUBTROPICAL VEGETABLES**Credits 2:0:1****Course Objective:**

- To impart knowledge on basic cultural practices of vegetables crops.
- To insist on modern techniques to increase the yield and production.

- To learn about the economic estimation of commercial vegetable crops.

Course Outcome:

- The student gains a thorough knowledge on basic production technology.
- Familiarize on basic gardening techniques.
- Acquaintance on commercial oriented cultural practices.

Theory

Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield, post-harvest handling, economics and marketing of tropical and subtropical vegetable crops such as tomato, brinjal, chillies, capsicum, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca, basella, sorrel and roselle.

Practical

Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and intercultural; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation.

Text book

1. S. Thamburaj, 2014. Text book of vegetable, tuber crops and Spices. ICAR, New Delhi
2. B.R.Choudhary, 2009. A Text book on production technology of vegetables. Kalyani Publishers. Ludhiana.
3. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. ed. by K.V. Peter, New India Publishing Agency, New Delhi.
4. T.K.Bose, 2002. Vegetable Crops. Nayaprakash. Kolkata
5. P.Hazra, 2011. Modern Technology in Vegetable Production. New India Publishing Agency. New Delhi.
6. T.R.Gopal Krishnan, 2007. Vegetable Crops. New India Publishing Agency. New Delhi.
7. K.V.Kamath, 2007. Vegetable Crop Production. Oxford Book Company. Jaipur
8. M.S.Dhaliwal, 2008. Handbook of Vegetable Crops. Kalyani Publishers. Ludhiana

18HO1006 IRRIGATION AND WEED MANAGEMENT IN HORTICULTURAL CROPS

Credits 2:0:1

Course objectives

- To study soil, water and plant relationships and soil moisture constant with special reference to horticultural plants
- To introduce the concepts of water requirement of horticultural crops and its irrigation management
- To study the importance of weeds its classification and management with reference to horticultural plants

Course objectives

- Students gained practical knowledge on surface irrigation, pressurized irrigation, micro irrigation and fertigation
- Students learnt the layout of micro irrigation (Drip irrigation) to the horticultural crops
- Students gained knowledge on the principles of integrated weed management with special reference to horticultural plants

Theory

Importance of water, water resources in India. Area of different crops under irrigation, function of water for plant growth, effect of moisture stress on crop growth. Available and unavailable soil moisture – distribution of soil moisture – water budgeting – rooting characteristics – moisture extraction pattern. Water requirement of horticultural crops – lysimeter studies – Plant water potential climatological approach – use of pan evaporimeter – factor for crop growth stages – critical stages of crop growth for irrigation. Irrigation scheduling – different approaches – methods of irrigation – surface and sub-surface pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops. Layout of different irrigation systems, drip, sprinkler. Layout of underground pipeline system.

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

Practical

Measurements of irrigation water by using water measuring devices, use of common formula in irrigation practices, practicing of land leveling and land shaping implements, layout for different methods of irrigation. Estimation of soil moisture constants and soil moisture by using different, methods and instruments, scheduling of irrigation, different approaches, practicing use of instruments, estimation of irrigation efficiency and water requirements of horticultural crops, irrigation planning and scheduling, soil moisture conservation practices. Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices; Tours and visits of problem areas.

Text books

1. Rao, Y.P. and Bhaskar, S.R. 2008. Irrigation Technology. Theory and practice. Agrotech publishing Academy, Udaipur.
2. Dilip Kumar Mujmdar. 2004. Irrigation Water Management: Principles and Practices. Prentice Hall of India Pvt. Ltd.,
3. S.V. Patil&Rajakumar, G. R., 2016. Water Management in Agriculture and Horticultural Crops. Satish serial publishing House, Delhi.

18HO2001 COMMERCIAL FLORICULTURE

Credits 2:0:1

Course objectives

- To educate students on commercial flower crops and their market thrust.
- To know about production technology of loose and cut flowers.
- To know about harvesting and post-harvest handling of loose and cut flowers.
- To know about concrete and other floral extraction methods.

Course outcomes

- Understand the production technology of commercial flowers

- Understanding the harvesting and post-harvest handling of loose and cut flowers
- Equipped for entrepreneurship in commercial floriculture

Theory

Scope and importance of commercial floriculture in India, production techniques of commercial flower crops like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, crossandra, anthurium, dahlia, tuberose, bird of paradise, china aster and gerbera for domestic and export market, production techniques of flowers and foliage filler materials growing of flowers under protected environments such as glass house, plastic house etc., postharvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, production techniques for bulbous.

Practical

Identification of commercially important floricultural crops. Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals. Propagation by cutting, layering, budding and grafting. Training and pruning of roses. Use of chemicals and other compounds for prolonging the vase life of cut flowers. Drying and preservation of flowers. Flower arrangement practices.

Reference books

1. Bose, T.K., Yadav, L.P., Pal. P., Parthasarathy, V.A., Das. P., 2003. Commercial flowers. Vol.I and II.Nayaudyog, Kolkata-6.
2. Prasad, S. and U. Kumar, 1998. Commercial floriculture. Agro Botanica. Bikaner - 334 003.
3. Vishnu Swarup. 1997. Ornamental Horticulture. Macmillan India Ltd., NewDelhi-2.
4. Foja Singh, 1997. Advances in Floriculture. Media Today Pvt Ltd., New Delhi-17
5. Roy.A.Larson.1992. Introduction of Floriculture. International Book Distributing Co., Lucknow.
6. Bose,T. K. and P. Yadav. 1989. Commercial flowers. NayaPrakash, Calcutta
7. Bose, T.K., Yadav, L.P., Pal. P., Parthasarathy, V.A., Das. P., 2003. Commercialflowers. Vol.I and II.Nayaudyog, Kolkata-6.
8. Bhattacharjee and De. L.C. 2004 – Advanced Commercial Floriculture. Vol. I & II.
9. Bhattacharjee, S.K., 2004 – Advanced commercial floriculture. Vol. I and II.

18HO2002 PRODUCTION TECHNOLOGY OF SPICES AND PLANTATION CROPS

Credits 2:0:1

Course Objectives

- To teach scope and importance of spices and plantation crops
- To impart knowledge on production technology of spices and plantation crops
- To impart knowledge on special horticultural practices, various processes and their uses

Course Outcome

- Scope and importance of spices and plantation crops learned
- Production technology of spices and plantation plants studied
- Gain practical knowledge on various processes and their commercial uses

Theory

Spices: History, scope and importance, Present status, area and production, uses, export potential and role in national economy. Classification, soil and climate, propagation-seed, vegetative and micro-propagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper. Export Promotion Council, institutions and research centers in R&D. Crops: Cardamom, pepper, betel

vine ginger, turmeric, clove, nutmeg, cinnamon, all spice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.

Plantation crops: History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut, oil palm, palmyrah palm, cacao, cashew nut, coffee, tea, Date palm and rubber.

Practical

Spices: Identification of varieties: propagation, seed treatment – sowing; layout, planting; hoeing and earthing up; manuring and use of weedicides, training and pruning; fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins.

Plantation crops: Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens, manuring, irrigation; mulching, raising masonry nursery for palm, nursery management in cacao. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood, grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea. Visit to commercial plantations.

Text books

1. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil
2. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. ed. by K.V. Peter, New India Publishing Agency, New Delhi.
3. Shanmugavelu, K.G., N. Kumar and K.V. Peter 2005. Production Technology of Spices and Plantation Crops. Agrobios (India), Jodhpur.
4. Nybe, E.V., N. Miniraj and K.V. Peter. 2007. Spices – Horticulture Science Series Vol. 5. New India Publishing Agency, New Delhi.

18HO2003 PRECISION FARMING AND PROTECTED CULTIVATION

Credits 2:0:1

Course objectives

- To impart knowledge on the protected cultivation of vegetables, fruits and flower crops
- To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops
- To learn about precision production technology for important horticultural crops

Course outcomes

- Gain knowledge on the protected cultivation of vegetables, fruits and flower crops
- Gain practical knowledge on hi-tech production technology of fruits, vegetables and flower crops
- Learn about precision production technology for important horticultural crops

Theory

Precision farming – laser leveling, mechanized direct seed sowing; seedling and sapling transplanting, mapping of soils and plant attributes, site specific input application, weed management, insect pests and disease management, yield mapping in horticultural crops. Green house technology, Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses,

Design criteria of greenhouse for cooling and heating purposes. Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies. Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics.

Practical

Study of different types of greenhouses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial greenhouses; Economics of protected cultivation.

Reference books

1. Handbook of agricultural engineering, 2016. ICAR, New Delhi.
2. Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.

18HO2004 DISEASES OF FRUIT, PLANTATION, MEDICINAL AND AROMATIC CROPS **Credits 2:0:1**

Course objectives

- To study about Etiology, symptoms, mode of spread and survival of diseases
- To study the symptoms of major diseases and host parasite relationship
- To impart knowledge on integrated management of important diseases of fruit, Plantation, Medicinal and Aromatic Crops

Course outcomes

- Learnt about Etiology, symptoms, mode of spread and survival of diseases
- Gain knowledge of symptoms of major diseases and host parasite relationship
- Learnt about integrated management of important diseases of fruit, Plantation, Medicinal and Aromatic Crops

Theory

Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits, plantation, medicinal and aromatic crops viz mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear, peach, plum, almond, walnut, strawberry, areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, Solanum khasianum and Tephrosia. Important post-harvest diseases of fruit, plantation and medicinal and aromatic crops and their management.

Practical

Observations of disease symptoms, identification of casual organisms and host parasite relationship of important diseases. Examination of scrapings and cultures of important pathogens of fruits, plantation, medicinal and aromatic crops.

Reference books

1. Arjunan.G. Karthikeyan, G, Dinakaran ,D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore

2. Rangaswamy C.2005, Diseases of crop plants in India –. Prentice Hall of India, Pvt. Limited, New Delhi

18HO2005 SOIL FERTILITY AND NUTRIENT MANAGEMENT

Credits 1:0:1

Course Objectives:

1. To study the role of nutrients in horticultural crop production
2. To learn the soil fertility evaluation and soil testing methods
3. To familiarize the concept and management of INM

Course Outcome:

1. Studied the role of nutrients in horticultural crop production
2. Learnt the soil fertility evaluation and soil testing methods
3. Familiarized the concept and management of INM

Theory

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements-functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils – characteristics and management. Soil organic matter, Role of microorganisms in organic matter-decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition, soil buffering capacity. Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis. Plant nutrient toxicity symptoms and remedies measures. Soil test crop response and targeted yield concept. Biofertilizer. Nutrient use efficiency and management. Secondary and micronutrient fertilizer. Fertilizer control order. Manures and fertilizers classification and manufacturing process. Properties and fate of major and micronutrient in soils. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity.

Practical

Analysis of soil for organic matter, available N, P and K and Micronutrients and interpretations. Gypsum requirement of saline and alkali soils. Lime requirement of acid soils. Estimation of organic carbon content in soil. Determination of Boron and chlorine content in soil. Determination of Calcium, Magnesium and Sulphur in soil. Sampling of organic manure and fertilizer for chemical analysis. Physical properties of organic manure and fertilizers. Total nitrogen in urea and farmyard manure. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer. Estimation of water soluble P₂O₅, Ca and S in SSP, Lime and Gypsum. Estimation of Potassium in MOP/SOP and Zinc in zinc sulphate. Visiting of fertilizer testing laboratory.

Text books

1. Mengel, et al., 2001. Principles of Plant Nutrition (5th Edition), Springer.
2. Das, D .K., 2011. Introductory Soil Science (3rd Edition), Kalyani Publisher, Ludhiana (India).
3. Yawalkar K S, Agarwal JP and Bokde S, 1992. Manures and Fertilizers. Agri. Horticultural Publishing House, Nagpur.
4. Havlin et al. 2014. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (8th Edition), PHI Learning Pvt. Ltd., Delhi.

18HO2006 PRODUCTION TECHNOLOGY OF TEMPERATE VEGETABLE CROPS

Credits 1:0:1

Course objectives

- To familiarize the students about the scenario of temperate vegetable crops cultivation
- To know about advanced production technologies of temperate vegetable crops
- To learn about post-harvest handling of temperate vegetable crops

Course outcomes

- Scope and importance of temperate vegetable crops learned
- Advance production technology of temperate vegetable crops studied
- Gain practical knowledge on post-harvest handling of temperate vegetable crops

Theory

Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of cabbage, cauliflower, knolkhol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, garlic, onion, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke, Vegetable kale.

Practical

Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.

Text books

1. Prem Singh Arya and S. Prakash 2002. "Vegetable growing in India", Kalyani publishers, New Delhi
2. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. ed. by K.V. Peter, New India Publishing Agency, New Delhi.
3. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. II & III NayaPrakash, Kolkata.

18HO2007 PRODUCTION TECHNOLOGY OF TEMPERATE FRUIT CROPS**Credits1:0:1****Course Objectives**

- To know the scenario and scope of temperate fruit crops
- To impart knowledge about the cultivation aspects of temperate fruit crops
- To study the different horticultural practices in cultivation of temperate fruit crops

Course Outcome

- Scope and Importance of temperate fruit crops learnt
- Practical knowledge on the cultivation aspects of temperate fruit crops
- Studied different horticultural practices in cultivation of temperate fruit crops

Theory

Classification of temperate fruits, detailed study of areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self-incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, plum, cherry, persimmon, strawberry, kiwi, Queens land nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chest nut. Re-plant problem, rejuvenation and special production problems like pre-mature leaf fall, physiological disorders, important insect – pests and diseases and their control measures. Special production problems like alternate bearing problem and their remedies.

Practical

Nursery management practices, description and identification of varieties of above crops, manuring and fertilization, planting systems, preparation and use of growth regulators, training and pruning in apple, pear, plum, peach and nut crops. Visit to private orchards to diagnose maladies. Working out economics for apple, pear, plum and peach.

Text books

1. Bose, T. K. S. K. Mitra, and D. S. Rathore. 1998. Temperate Fruits - Nayaprakash, Calcutta
2. Chattopadhyay, T.K., 2001. A Text Book on Pomology (4 volumes), Kalyani Publishers, Ludhiana.
3. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. ed. by K.V. Peter, New India Publishing Agency, New Delhi.

18HO2008 PRODUCTION TECHNOLOGY OF MEDICINAL AND AROMATIC CROPS

Credits 2:0:1

Course Objectives

- To learn scope and importance of medicinal and aromatic crops
- To study about production technology of medicinal and aromatic plants
- To impart knowledge on various processes, essential oil and their commercial uses

Course Outcome

- Scope and importance of medicinal and aromatic crops learned
- Production technology of medicinal and aromatic plants studied
- Gain practical knowledge various processes, essential oil and their uses of medicinal and aromatic plants

Theory

History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements. Plant protection, harvesting and processing of under mentioned important medicinal and aromatic plants. Study of chemical composition of a few important medicinal and aromatic plants, extraction, use and economics of drugs and essential oils in medicinal and aromatic plants. Therapeutic and pharmaceutical uses of important species. Storage techniques of essential oils. Medicinal Plants: Withania, periwinkle, Rauwolfia, Dioscorea, Isabgol, opium poppy Ammimajus, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass, flag (baje), lavender, geranium, patchouli, bursera, menthe, musk, occimum and other species relevant to the local conditions. Marketing.

Practical

Collection of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction of essential oils.

Text books

1. Alice Kurian, M. Asha Sankar (Authors) & K.V. Peter (Ed.), 2007. Medicinal Plants, (Horticulture Science Series-2) Published by New India Publishing Agency, New Delhi.
2. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil.
3. Chadha, K. L. (ed.) 2001. Handbook of Horticulture. ICAR Publication, New Delhi.

18HO2009 BREEDING OF VEGETABLES, MEDICINAL AND AROMATIC CROPS

Credits 3:0:1

Course objective

- To study the basics of floral biology of Vegetables, Medicinal and Aromatic crops
- To gain knowledge on pollination mechanism, breeding strategies in Vegetables, Medicinal and Aromatic crops

- To learn about methods of breeding and achievements in crop improvement of Vegetables, Medicinal and Aromatic crops

Course outcome

- To learnt basics of floral biology of Vegetables, Medicinal and Aromatic crops
- Practical knowledge gained on pollination mechanism, breeding strategies in Vegetables, Medicinal and Aromatic crops
- Learnt about methods of breeding and achievements in crop improvement of Vegetables, Medicinal and Aromatic crops

Theory

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops. Plant genetic resources, their conservation and utilization in crop improvement. Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, male sterility and incompatibility and their utilization in development of hybrids. Origin, distribution of species, wild relatives and forms of vegetable crops Tomato, Brinjal, Bhendi, Capsicum, Chilli, Cucurbits, Cabbage, Cauliflower, Tuber crops, Potato, Carrot, Radish. Breeding procedures for development of hybrids/varieties in various crops. Genetic basis of adoptability and stability. Floral biology, methods of breeding and achievements in crop improvement medicinal crops :senna, gloriosa and coleus and aromatic crops: mint and cymbopogon.

Practical

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. GCA, SCA, combining ability, heterosis, heterobeltosis, standard heterosis, GxE interactions (stability analysis) Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

Text Books

1. Prem Singh Arya, 2003. Vegetable breeding, production and seed production, Kalyani publishers, New Delhi.
2. Harihar Ram. 1998. Vegetable Breeding – Principles and Practices. Kalyanipublishers, New Delhi.
3. Akhilesh Sharma, VivekaKatoch, Susheel Sharma and Chanchal Rana, 2016. Practical on Vegetable breeding. Kalyani Publishers, New Delhi.

18HO2010 DISEASES OF VEGETABLES, FLOWERS, ORNAMENTAL AND SPICE CROPS

Credits 2:0:1

Course Objectives:

- To impart knowledge on diseases of vegetables, flowers, ornamental and spice crops
- To make the student understand the symptoms and their spread
- To learn basics of plant disease management

Course Outcome:

- Able to know and understand diseases of vegetables, flowers, ornamental and spice crops and losses
- Knowledge on symptoms and their mode of spread will be imparted
- Plant disease management will be studied

Theory

Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, turmeric, pepper, cumin,

cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, crossandra, tuberose, gerbera, anthurium, geranium. Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical

Observations of symptoms, causal organisms and host parasitic relationship of important diseases, examination of cultures of important pathogens of vegetables, ornamental and spice crops in field as well as in protected cultivation.

Reference books

1. Srikant Kulkarni, Yashoda R. Hedge. Diseases of Plantation crops and their management-, Agrotech publication Academy
2. S.L. Godara, BBS Kapoor, B.S. Rathore. Disease management of spice crops-, Madhu Publications.
3. L.DarwinChristdhar Henry and H.LewinDevasahayam Crop diseases: Identification, Treatment and Management. An Illustrated Handbook –, New India publishing Agency
4. Singh, R.S. 1994. Diseases of Vegetable Crops. Oxford IBH Publishing Co. Pvt. Ltd., New Delhi
y Singh, R.S 1996. Plant Diseases. Oxford IBH Publishing Co. Pvt. Ltd., New Delhi
5. Sohi, H.S. 1992. Diseases of Ornamental plants in India. ICAR, New Delhi
6. RangaSwamy, G. 1988. Diseases of Crop Plants in India. Prentice Hall of India Pvt. Ltd., New Delhi.
7. Saha, L.R. 2002. Hand Book of Plant Diseases. Kalyani Publishers
8. Arjunan, G. Karthikeyan, G. Dinakaran, D. Raguchander, T. 1999. Diseases of Horticultural Crops. .Dept. of Plant Pathology, Tamilnadu Agricultural University Coimbatore.

18HO2011 INSECT PESTS OF FRUIT, PLANTATION, MEDICINAL & AROMATIC CROPS **Credits 2:0:1**

Course objective

- To learn about Insect Ecology and factors responsible for outbreaks
- To study on methods of pest control in Fruit, Plantation, Medicinal & Aromatic crops
- To learn about integrated pest management of Fruit, Plantation, Medicinal & Aromatic crops

Course outcome

- Learnt about Insect Ecology and factors responsible for outbreaks
- Practical knowledge on methods of pest control in Fruit, Plantation, Medicinal & Aromatic crops
- Gain knowledge on integrated pest management of Fruit, Plantation, Medicinal & Aromatic crops

Theory

General – economic classification of insects; Bio-ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine senna, neem, belladonna, pyrethrum, costus, crotalaria, datura, *Dioscorea*, mint, opium, *Solanum khasianum* and. Storage insects – distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their maximum residue limits (MRLs).

Practical

Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinal and aromatic crops in field and storage.

Text Books

1. David, B.V. 2006. Elements of Economic Entomology. Popular Book Depot, Chennai.
2. Butani, D.K. 2009. Insects and Fruits. Periodical Expert Book Agency, New Delhi.

18AT2001 FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS**Credits 3:0:1****Objectives**

- To understand the basic principles, fundamental concepts and theories of fluid mechanics
- To impart knowledge on static, kinematics and dynamic aspects of fluids
- To learn the losses occurring in fluid flow and flow measurements

Outcomes

- The students will be able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- They will also gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.
- The students will be able to apply their knowledge on design and measurement of irrigation channels

Theory

Properties of fluids, Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies; Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon; Laminar and turbulent flow in pipes, general equation for head loss Darcy equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient; Flow through orifices, Flow through Mouthpieces, Notches, Weirs, Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Open channel design and hydraulics: Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels, Hydraulic jump; Dimensional analysis and similitude: Rayleigh's method and Buckingham's 'Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers.

Practical

1. Verification of Bernoulli's theorem
2. Measurement of discharge with a venturimeter
3. Measurement of velocity with a pilot tube
4. Determination of coefficient of discharge of rectangular weir
5. Determination of coefficient of discharge of triangular weir
6. Determination of coefficient of discharge of trapezoidal weir
7. Determination of hydraulic coefficient of orifices
8. Experiment on broad crested weir
9. Determination of head losses in pipes
10. Experiments on open channels
11. Determination of roughness coefficients of open channels
12. Measurement of velocity and pressure profiles in open channels

Text Books

1. Bansal, R.K., A text book of Fluid Mechanics and Hydraulic Machinery, Laxmi Publications (P) Ltd., New Delhi, 2002.

2. P M and Seth S.M.1973. Hydraulics and Fluid Mechanics. Standard Book House, Delhi.
3. Khurmi, R .S. 1970. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines S. Chand & Company Limited, New Delhi.

Reference Books

1. Chow V T 1983. Open Channel Hydraulics. McGraw Hill Book Co., New Delhi.
2. LalJagadish 1985. Fluid Mechanics and Hydraulics. Metropolitan Book Co.Pvt. Ltd., New Delhi.

18AT2002 ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS AND FOOD QUALITY

Credits 2:0:0

Objectives

- To acquaint and equip the students with different engineering properties of biological materials.
- To learn the flow behavior of food materials.
- To impart knowledge on the application in design of food processing equipments.

Outcomes

- The students will get a basic knowledge of the various properties of solid and liquid food materials.
- They will also gain the knowledge in addressing problems in the bio material conveying systems.
- The students will be able to apply their knowledge on design equipments.

Theory

Classification and importance of engineering properties of Agricultural produce, shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables, Thermal properties; Co-efficient of thermal expansion, Friction in agricultural materials; Static friction, Kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow of bulk granular materials, Aero dynamics of agricultural products, drag coefficients, terminal velocity. Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behaviour, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic, Rheopectic and Bingham Plastic Foods, Flow curves. Electrical properties; dielectric loss factor, loss tangent, conductivity and dielectric constant, method of determination. Application of engineering properties in handling processing machines and storage structures

Text Books

1. Mohesin, N.N. 1980. Physical Properties of Plants & Animals. Gordon & Breach Science Publishers , New York.
2. Singhal OP & Samuel DVK. 2003. Engineering Properties of Biological Materials. Saroj Prakashan.
3. Rao, M.A. and Rizvi, S.H., 1995. Engineering Properties of Foods. Marcel Dekker Inc. New York.

Reference Books

1. Mohesin, N.N. 1980. Thermal Properties of Foods and Agricultural Materials. Gordon & Breach Science Publishers , New York.
2. Prentice, J.H. 1984. Measurement in Rheological Properties of Food Stuffs. Elsevier Applied science Pub. Co. Inc. New York.

18AT2003 POST-HARVEST ENGINEERING OF CEREALS, PULSES AND OILSEEDS

Credits 2:0:0

Objectives

- To equip the students with various post harvest techniques of food materials.
- To acquire basic concept of various unit operation in processing.

- To impart knowledge on the processing of a wide range of food products.

Outcomes

- The students will get a basic knowledge on post harvest techniques material handling equipments.
- They will also gain the knowledge in addressing problems in post harvest engineering of food grains.
- The students will be able to apply their knowledge on selection of equipments for various unit operations.

Theory

Milling of rice- Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. Milling of wheat, unit operations and equipment. Milling of pulses: traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling. Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran., Extrusion cooking: principle, factors affecting, single and twin screw extruders. By-products utilization.

Text Books

1. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
2. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
3. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.

Reference Books

1. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
2. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi
3. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
4. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
5. Singh, R. Paul. and Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.

18AT2004 FARM MACHINERY AND EQUIPMENT-I

Credits 2:0:1

Objectives

- To expose the students to farm mechanization benefits and constraints.
- To equip the students in the identification of components of implements.
- To impart knowledge on the working principles of farm equipments, tillage implements.

Outcomes

- The students will be able to understand the mechanization in agricultural farms.
- The students will gain knowledge on the various equipment used in the farm for different field operations.
- The students will be able to apply their knowledge on selection of equipments for various operations.

Theory

Introduction to farm mechanization. Classification of farm machines. Unit operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls

of farm machinery. Calculation of field capacities and field efficiency. Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment. Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, cultivators, Identification of major functional components. Attachments with tillage machinery. Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills. Introduction to planters, bed-planters and other planting equipment. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines.

Practical

1. Familiarization with different farm implements and tools.
2. Study of hitching systems.
3. Problems on machinery management.
4. Study of primary and secondary tillage machinery – construction, operation, adjustments and calculations of power and draft requirements.
5. Study of sowing and planting equipment – construction, types, calculation for calibration and adjustments.
6. Study of transplanters – paddy, vegetable, etc.
7. Identification of materials of construction in agricultural machinery and study of material properties.
8. Study of heat treatment processes subjected to critical components of agricultural machinery.

Text Books

1. Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
2. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 2010.
3. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005

Reference Books

1. Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi, 1996.
2. Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

18AT2005 TRACTOR SYSTEMS AND CONTROLS

Credits 2:0:0

Objectives

- To equip the student with sufficient knowledge about tractor and its various systems, their principles of operation and types, components etc.
- To impart knowledge on the concept of traction and mechanics of tractor.
- To introduce the ergonomic and safety considerations in tractors; and tractor testing.

Outcomes

- The students will be able to understand the various components of tractors.
- The students will have the knowledge on earth moving machineries and tractor classification and tillage implements.
- The students will acquire knowledge on the controls and trouble shooting of farm tractors.

Theory

Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation.

Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors. Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC. Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids. Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety.

Text Books

1. Liljedahl, J. B., Turnquist, P. K., Smith, D. W., and Hokey, M. 2004. Tractors and Their Power Units. CBS Publishers and Distributors Pvt. Ltd, New Delhi
2. Jain, S. C., and Rai, C. R. 2013. Farm Tractor Maintenance and Repair. Standard Publishers Distributors, Delhi

Reference Books

1. Kirpal Singh. 2013. Automobile Engineering Vol. I. Standard Publishers Distributors, Delhi
2. Relevant BIS Test Codes for Tractors.
3. Singh, S., and Verma, S. R. 2009. Farm Machinery Maintenance and Management. Indian Council of Agricultural Research, New Delhi
4. Black, P.O. 1996. Diesel engine manual. Taraporevala Sons & Co., Mumbai.
5. Grouse, W.H. and Anglin, D.L. 1993. Automotive mechanics. Macmillan McGraw- Hill, Singapore.
6. Indian Standard Codes for Agril. Implements. Published by ISI, New Delhi.

18AT2006 FARM MACHINERY AND EQUIPMENT-II

Credits 2:0:1

Objectives

- To expose the students to farm mechanization benefits and constraints.
- To equip the students in the identification of components of implements.
- To impart knowledge on the working principles of farm equipments during field operations.

Outcomes

- The students will be able to understand the mechanization in agricultural farms.
- The students will gain knowledge on the various equipment used in the farm for different field operations.
- The students will be able to apply their knowledge on selection of equipments for various operations.

Theory

Introduction to plant protection equipment – sprayers and dusters. Classification of sprayers and sprays. Types of nozzles. Calculations for calibration of sprayers and chemical application rates. Introduction to interculture equipment. Use of weeders – manual and powered. functional requirements of weeders and main components. Familiarization of fertilizer application equipment. Study of harvesting operation –

harvesting methods,. Study of mowers – types, constructional details, working and adjustments. Study of shear type harvesting devices – cutter bar, inertial forces, counter balancing, terminology, cutting pattern. Study of reapers, binders and windrowers – principle of operation and constructional details. Importance of hay conditioning, methods and calculation of moisture content of hay. Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications. Types of threshers- constructional details and cleaning systems. Study of factors affecting thresher performance. Study of grain combines, combine terminology, classification of grain combines, study of material flow in combines. Computation of combine losses, study of combine troubles and troubleshooting. Study of chaff cutters and capacity calculations. Study of straw combines – working principle and constructional details. Study of root crop diggers – principle of operation, blade adjustment and approach angle, and calculation of material handled. Study of potato and groundnut diggers. Study of Cotton harvesting – Cotton harvesting mechanisms, study of cotton pickers and strippers, functional components. Study of maize harvesting combines. Introduction to vegetables and fruit harvesting equipment and tools.

Practical

1. Familiarization with plant protection and interculture equipment.
2. Study of sprayers, types, functional components.
3. Study of dusters, types and functional components.
4. Calculations for chemical application rates.
5. Study of nozzle types and spread pattern using patternator.
6. Familiarization with manual and powered weeding equipment and identification of functional components.
7. Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters.
8. Study of various types of mowers, reaper, reaper binder.
9. Familiarization with threshing systems, cleaning systems in threshers.
10. Calculations of losses in threshers.
11. Familiarization with functional units of Grain combines and their types.
12. Calculations for grain losses in a combine.
13. Study of root crop diggers and familiarization with the functional units and attachments. Familiarization with the working of cotton and maize harvesters.
14. Familiarization with vegetable and fruit harvesters.

Text Books

1. Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
2. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 2010.
3. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005

Reference Books

1. Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi,1996.
2. Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

18AT2007 FIELD OPERATION AND MAINTENANCE OF TRACTORS AND FARM MACHINERY

Credits 0:0:2

Objectives

- To familiarize the students with agricultural tractors and power tillers, its systems, operation, maintenance and safety precautions.
- To explain the application of different farm machinery in the field on tillage, sowing, plant protection, harvesting and threshing.

- To impart skill and technical know-how on dismantling and reassembling, care, maintenance and safety of farm machines.

Outcomes

- The students will be able to understand the mechanization in agricultural farms.
- The students will gain knowledge on the operation of various equipment used in the farm for different field operations.
- The students will be able to apply their knowledge on selection of equipments for various operations.

Practical

1. Familiarization with different makes and models of agricultural tractors.
2. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems.
3. Study of maintenance points to be checked before starting a tractor.
4. Familiarization with controls on a tractor.
5. Safety rules and precautions to be observed while driving a tractor.
6. Driving practice of tractor.
7. Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field.
8. Study of field patterns while operating a tillage implement.
9. Hitching & De-hitching of mounted and trail type implement to the tractor.
10. Driving practice with a trail type trolley – forward and in reverse direction.
11. Introduction to tractor maintenance – precautionary and break-down maintenance.
12. Care and maintenance procedure of agricultural machinery during operation and off-season. Repair and maintenance of implements – adjustment of functional parameters in tillage implements.
13. Replacement of furrow openers and change of blades of rotavators.
14. Adjustments in a thresher for different crops. Replacement of V-belts on implements.
15. Setting of agricultural machinery workshop.

Reference Manuals

1. Ghosh, R. K., Swan, S. 1993. Practical Agricultural Engineering. Kolkata NayaPrakosh.
2. Jain, S. C., and Rai, C. R. 2013. Farm Tractor Maintenance and Repair. Standard Publishers Distributors, New Delhi.
3. Operators Manuals of Tractors.
4. Service manuals provided by manufacturers.
5. Surendra Singh, Verma, S. R. 2009. Farm Machinery Maintenance and Management. Indian Council of Agricultural Research, New Delhi.

18AT2008 POST-HARVEST ENGINEERING OF HORTICULTURAL CROPS

Credits 2:0:0

Objectives

- To equip the students with processing and handling of fruits and vegetables.
- To understand the various unit operations involved in the processing of horticultural crops.
- To facilitate the utilization of various equipments used for the processing of fruits and vegetables.

Outcomes

- The students will be able to understand the various processes in post harvest technology of horticultural crops.
- The students will apply their knowledge on the operation of various processing equipments.
- The students will be able to apply their knowledge on selection of equipments for various operations.

Theory

Importance of processing of fruits and vegetables, spices, condiments and flowers. Characteristics and properties of horticultural crops important for processing, Peeling: Different peeling methods and devices (manual peeling, mechanical peeling, chemical peeling, and thermal peeling), Slicing of horticultural crops: equipment for slicing, shredding, crushing, chopping, juice extraction, etc., Blanching: Importance and objectives; blanching methods, effects on food, Chilling and freezing: Application of refrigeration in different perishable food products, Thermophilic, mesophilic & Psychrophilic micro-organisms, Chilling requirements of different fruits and vegetables, Freezing of food, freezing time calculations, slow and fast freezing, Equipment for chilling and freezing (mechanical & cryogenic), Effect on food during chilling and freezing, Cold storage heat load calculations and cold storage design, refrigerated vehicle and cold chain system, Dryers for fruits and vegetables, Osmo-dehydration, Packaging of horticultural commodities, Packaging requirements (in terms of light transmittance, heat, moisture and gas proof, micro organisms, mechanical strength), Different types of packaging materials used for raw and processed fruits and vegetables products, bulk and retail packages and packaging machines, handling and transportation of fruits and vegetables, Pack house technology, Minimal processing, Common methods of storage, Low temperature storage, evaporative cooled storage, Controlled atmospheric storage, Modified atmospheric packaging, Preservation Technology, General methods of preservation of fruits and vegetables, advantages and disadvantages of different physical/ chemical and other methods of preservation, Flowcharts for preparation of different finished products, equipment used for different unit operations, Quality control in fruit and vegetable processing industry.

Text Books

1. Sudheer, K P. and Indira, V. 2007. Post Harvest Engineering of horticultural crops. New india Publishing House.
2. Pandey, R.H. 1997. Postharvest Technology of fruits and vegetables (Principles and practices), Saroj Prakashan, Allahabad.

Reference Books

1. Arthey, D. and Ashurst, P. R. 1966. Fruit Processing. Chapman and Hall, New York.
2. Pantastico, E.C.B. 1975. Postharvest physiology, handling and utilization of tropical and subtropical fruits and vegetables AVI Pub. Co., New Delhi.

18AT2009 SOIL AND WATER CONSERVATION ENGINEERING

Credits 2:0:1

Objectives

- To present the concepts and causes of erosion and the problems associated with it.
- To enable the students to make use of the principles and concepts to solve issues related to soil and water management.
- To equip the students with proper application of different soil and water conservation measures to restore the productivity of the soil.

Outcomes

- The students will be able to gain fundamental knowledge on the concepts of erosion and sedimentation.
- They will have sufficient knowledge on soil and water conservation measures.
- The students will apply their knowledge on the design of various soil and water conservation measures.

Theory

Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development. Soil loss estimation – Universal

soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation methods. Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. Engineering measures- Bunds and terraces. Bunds - contour and graded bunds - design and surplussing arrangements. Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching. Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. Grassed waterways and design. Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.

Practical

1. Study of different types and forms of water erosion.
2. Exercises on computation of rainfall erosivity index.
3. Computation of soil erodibility index in soil loss estimation.
4. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE.
5. Exercises on soil loss estimation/measuring techniques.
6. Study of rainfall simulator for erosion assessment.
7. Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor. Determination of sediment concentration through oven dry method.
8. Design and layout of contour bunds. Design and layout of graded bunds.
9. Design and layout of broad base terraces.
10. Design and layout of bench terraces.
11. Design of vegetative waterways.
12. Exercises on rate of sedimentation and storage loss in tanks.
13. Computation of soil loss by wind erosion.
14. Design of shelterbelts and wind breaks for wind erosion control.
15. Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.

Text Books

1. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
2. Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
3. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Reference Books

1. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
2. Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
3. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
4. Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaka, New York, USA.

18AT2010 FUNDAMENTALS OF RENEWABLE ENERGY SOURCES

Credits 2:0:0

Objectives

- To make the student aware on the various basic aspects of energy use and its environmental impact.
- To introduce the different classifications of major renewable energy sources and technologies.
- To provide sufficient knowledge on alternate energy sources (solar energy and wind energy) and their applications.

Outcomes

- The students will attain fundamental knowledge on the concepts of bio energy sources and its applications.
- The students will be able to classify the various conventional and renewable energy sources.
- The students will be able to apply their knowledge on the design of solar and wind energy systems.

Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources. Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through, Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaics: p-n junctions. Solar cells, PV systems, Stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics. Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, working principle of wind power plant. Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry.

Text Books

1. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
3. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

Reference Books

1. Rathore N. S., Kurchania A.K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.
2. Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
3. Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.

18AT2011 EXTENSION METHODOLOGIES AND TRANSFER OF AGRICULTURAL TECHNOLOGY

Credits 2:0:0

Objectives

- To enable the learners of to understand the extension and basic communication skills.
- To impart knowledge about the transfer of technology using extension technologies.
- To provide skills on transferring technologies in the field.

Outcomes

- The students will attain the basic concepts of extension and basic communication skills.
- The students will gain knowledge about the transfer of technology using extension technologies.
- The students will be capable of transferring technologies in the field through effective extension methodologies.

Communication and Programme Planning-Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes. Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits. Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone. Diffusion and Adoption - Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption. Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC & KVK.

Text Books

1. Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
2. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork

Reference Books

1. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
2. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

18AT2012 DAIRY AND FOOD ENGINEERING

Credits 2:0:1

Objectives

- To disseminate the knowledge of properties of products, unit operations and packaging involved in dairy and food engineering.
- To introduce the students to dairy industry, properties and processing of milk, manufacture of dairy products , sanitation and effluent treatment in dairy industry
- To expose the students to the fundamental knowledge of food, its properties and different methods of food processing

Outcomes

- The students will gain knowledge about Dairy and Food process engineering
- The students will understand the process of manufacturing of dairy products and thermal processing of food.
- The students will understand the importance of quality control and food preservation and packaging.

Theory

Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Dairy development in India, Engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems. Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products;

Dairy plant design and layout, Plant utilities; Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression, Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying, Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing.

Practical

1. Study of pasteurizers.
2. Study of sterilizers.
3. Study of homogenizers.
4. Study of separators.
5. Study of butter churns.
6. Study of evaporators.
7. Study of milk dryers.
8. Study of freezers.
9. Study of filtration.
10. Design of food processing plants & preparation of layout.
11. Visit to multi-product dairy plant.
12. Estimation of steam requirements, Estimation of refrigeration requirements in dairy & food plant.
13. Visit to Food industry.

Text Books

1. Tufail Ahmed., “Dairy Plant Engineering and Management”, Kitab Mahal Publishers, Allahabad, 1997.
2. McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
3. Rao, D.G. 2010. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi.

Reference Books

1. Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press.
2. Toledo, R. T. 1997. Fundamentals of Food Process Engineering. CBS Publisher.

18AT2013 STORAGE STRUCTURES AND PACKAGING TECHNOLOGY

Credits 2:0:1

Objectives

- To understand the underlying principles of spoilage and storage.
- To highlight the various standards and the environmental parameters involved in the design of such storage structures.
- To provide knowledge on different storage methods and packaging techniques for food materials.

Outcomes

- The students will have a clear understanding of various methods of storage and different packaging techniques for food.
- The students will be able to design proper storage structures for food grains.
- The students will have sufficient knowledge on various packaging materials and their manufacturing process.

Theory

Spoilage and storage- Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses. Storage methods- Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables-construction operation and maintenance of CA storage facilities. Functions of packaging materials-

Introduction – packaging strategies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials. Food Packaging Materials and Testing- Introduction – paper and paper boards - flexible - plastics - glass containers – cans – aluminium foils - package material testing-tensile, bursting and tear strength. Special Packaging Techniques- Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.

Practical

1. Design of shallow bins
2. Design of deep bins
3. Experiments with evaporative cold storage structure
4. Design of Cold Storage unit
5. Experiment on CA Storage for fruits
6. Experiment on CA Storage for grains
7. Testing of tensile Strength of packaging materials
8. MAP storage of fruits and vegetables
9. Experiment on Vacuum packaging of fruits and vegetables
10. Experiment on canning of fruits
11. Experiment on bottling of fruit products
12. Experiment on Form Fill Seal Machine for Liquids
13. Experiment on Form Fill Seal Machine for Powder foods
14. Visit to FCI godown
15. Visit to packaging Industry

Text Books

1. Sahay, K.M. and K.K.Singh. 1996. Unit Operations of Agricultural Processing. Vikas publishing house Pvt.ltd., New Delhi.
2. Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
3. Pandey, P.H. Principles and practices of Agricultural Structures and Environmental Control, Kalyani Publishers, Ludhiana.
4. Coles, R., McDowell, D., Kirwan, M .J. 2003. Food Packaging Technology. Blackwell Publishing Co.

Reference Books

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2. Chakaraverty, A. 2000. third edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.
3. Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.
4. Robertson, G. L. 2005. Food Packaging: Principles and Practice. Second Edition. Taylor and Francis Pub.

18AT2014 AGRICULTURAL WASTE AND BY-PRODUCTS UTILIZATION

Credits 2:0:0

Objectives

- To acquaint and equip the students with the proper utilization of agricultural waste and by-products.
- To understand the development of value added products from wastes.
- To identify suitable methods for the conversion of wastes into value added products.

Outcomes

- The students will acquire knowledge on the utilization of agricultural wastes.

- The students will be able to design proper methods for conversion of wastes.
- The students will find solutions for safe and efficient disposal and utilization of various agricultural wastes.

Theory

Types and formation of by-products and waste; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc., Concept, scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermin-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste–trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments: Advanced waste water treatment process–sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation, Effluent treatment plants, Environmental performance of food industry to comply with ISO-14001 standards.

Text Books

1. Vasso Oreopoulou and Winfried Russ (Edited). 2007. Utilization of By-products and Treatment of waste in the Food Industry. Springer Science & Business media, LLC 233 New York.
2. Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.
3. Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Sub-tropical fruits and vegetables, AVI Pub. Co.
4. Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling – A Systems approach, Academic Press Inc.

Reference Books

1. USDA. 1992. Agricultural Waste Management Field Hand book. USDA, Washington DC.
2. Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag.
3. V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization. New India Publishing Agency.
4. Prashar, Anupama and Bansal, Pratibha. 2007-08. Industrial Safety and Environment. S.K. Kataria and sons, New Delhi
5. Garg, S K. 1998. Environmental Engineering (Vol. II) – Sewage Disposal and Air Pollution Engineering. Khanna Publishers, New Delhi
6. Bhatia, S.C.. 2001. Environmental Pollution and Control in Chemical Process Industries. Khanna Publishers, New Delhi.

18AT2015 GROUND WATER, WELLS AND PUMPS

Credits 2:0:0

Objectives

- To equip the students with the occurrence, development and hydraulics of ground water flow.
- To understand the theories and application of wells and pumps.
- To impart knowledge in areas of well design, construction and management of wells.

Outcomes

- The students will know the technical aspects of groundwater, its availability, assessment and utilization.

- The students will be familiarized with the theory behind well design.
- The students will have the ability to construct and management of wells.

Theory

Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tubewells and open wells, familiarization of various types of bore wells; design of open wells; groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method(Theis, Jacob and Chow's), Theis recovery method; well interference, multiple well systems, estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques; pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Text Books

1. Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata Mc-Graw Hill.
2. Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).

Reference Books

1. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.
2. Raghunath, H.M. Groundwater Hydrology, Wiley Eastern Ltd., 2000.

18AT2016 WATER HARVESTING AND SOIL CONSERVATION STRUCTURES

Credits 2:0:1

Objectives

- To familiarize the water harvesting techniques based on source, storage and use.
- To introduce the soil and water conservation structures.
- To impart awareness on the design requirements, planning for design, design procedures and stability analysis of different structures.

Outcomes

- The students will be able to gain fundamental knowledge on the concepts of water harvesting.
- The students will have sufficient knowledge on soil and water conservation measures.
- The students will be able to design various soil and water conservation structures.

Theory

Water harvesting - principles, importance and issues. Water harvesting techniques- classification based on source, storage and use. Runoff harvesting – short-term and long-term techniques. Short-term harvesting techniques - terracing and bunding, rock and ground catchments. Long-term harvesting techniques - purpose and design criteria. Structures - farm ponds - dug-out and embankment reservoir types, tanks and subsurface dykes. Farm pond - components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction. Percolation pond - site selection, design and construction details. Design considerations of *nala* bunds. Soil erosion control structures - introduction, classification and functional requirements. Permanent structures for soil conservation and gully control - check dams, drop, chute and drop inlet spillways - design requirements, planning for design, design procedures and stability analysis. Hydraulic jump and its application. Drop spillway - applicability, types - straight drop, box-type inlet spillways - description, functional use, advantages and

disadvantages, straight apron and stilling basin outlet, structural components and functions. Loads on head wall, variables affecting equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension. Chute spillway - description, components, energy dissipaters, design criteria of Saint Antony Falls (SAF) stilling basin and its limitations. Drop inlet spillway - description, functional use and design criteria.

Practical

1. Study of different types of farm ponds.
2. Computation of storage capacity of embankment type of farm ponds.
3. Design of dugout farm ponds.
4. Design of percolation pond and *nala* bunds.
5. Runoff measurement using H-flume. Exercise on hydraulic jump.
6. Exercise on energy dissipation in water flow.
7. Hydrologic, hydraulic and structural design of drop spillway and stability analysis.
8. Design of SAF stilling basins in chute spillway.
9. Hydrologic, hydraulic and structural design of drop inlet spillway.
10. Design of small earthen embankment structures.
11. Practice on softwares for design of soil and water conservation structures.
12. Field visit to watershed project areas treated with soil and water conservation measures / structures.

Text Books

1. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
3. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Reference Books

1. Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1993. Soil and Water Conservation Engineering. 4th Edition, John Wiley and Sons Inc. New York.
2. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
3. Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR&TI, Dehradun, Allied Printers, Dehradun.

18AT2017 BIO ENERGY SYSTEMS: DESIGN AND APPLICATIONS

Credits 2:0:1

Objectives

- To provide in depth knowledge on basic principles of Bio-energy systems.
- To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.
- To provide skills in design and operation of major bio-energy systems.

Outcomes

- The students will be able to understand the concepts of bio energy sources and its applications.
- The students will be able to find solutions for bio mass conversion into energy.
- The students will be able to apply their technical know-how for the design of bio energy systems.

Theory

Fermentation processes and its general requirements, overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential. Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics. Biomass preparation techniques for harnessing (size reduction, densification and drying). Thermo-chemical degradation. History of small gas producer engine system. Chemistry of gasification. Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics. Trans-esterification for biodiesel production. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential.

Practical

1. Study of anaerobic fermentation system for industrial application.
2. Study of gasification for industrial process heat.
3. Study of biodiesel production unit.
4. Study of biomass densification technique (briquetting, pelletization, and cubing).
5. Integral bio energy system for industrial application.
6. Study of bio energy efficiency in industry and commercial buildings.
7. Design of Bio energy systems.
8. Study and demonstration of energy efficiency in building.
9. Measuring efficiency of different insulation technique.
10. Study of Brayton, Striling and Rankine cycles.
11. Study of modern greenhouse technologies.

Text Books

1. British BioGen. 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London, available on www.britishbiogen.co.uk.
2. Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.
3. Centre for biomass energy. 1998. Straw for energy production; Technology- Environment- Ecology. Available: www.ens.dk.

Reference Books

1. Chawla, O.P. 1986. Advances in biogas Technology, IARI, New Delhi.
2. Mathur, A.N. and Rathore N.S. 1992. Biogas production, management and utilization. Himanshu Publication. Delhi.
3. Mital, K.M., 1996, Biogas systems; Principles and applications, New Age International (P) Ltd. Publishers, New Delhi.
4. Rai G.D. 1989. Non-conventional Sources of energy. Khanna Publishers. Delhi.

18AT2018 IRRIGATION AND DRAINAGE ENGINEERING

Credits 2:0:1

Objectives

- To develop competency to design water conveyance systems and surface irrigation systems in the field.
- To understand the basic concepts for planning, design and management of land drainage works in cultivated areas.
- To study the various methods of land drainage and its impact on environment

Outcomes

- The students will have technical knowledge and skills on Planning, design, operation and management of reservoir system.

- The students will gain knowledge on different methods of irrigation.
- The students will be able to design proper drainage systems in the field.

Theory

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation – duty and delta - Rooting characteristics-Moisture use of crop, Evapotranspiration - ET – plot. Irrigation Requirement-Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies. Methods of Irrigation - Hydraulics and design - Erodible and non-erodible, alluvial channels- Kennedy's and Lacey's theories, Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system - Land grading - Land levelling methods. Command Area Development-Command area - Concept, Components of CADA - CADA programmes in Tamil Nadu - On Farm Development works, Execution - maintenance and economics of OFD works, Farmer's committee and its role for water distribution and system operation, Strategic outlet command - stream size for efficient warabandhi and rotational irrigation system. Agricultural drainage and system - Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy's law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.

Practical

1. River basins, irrigation projects, irrigation tanks and water resources in TN.
2. Determination of soil moisture by different methods (gravimetric, tensiometer, gypsum block and neutron probe method).
3. Problems on duty of water - Duty and delta relationship.
4. Estimation of water requirement by different methods.
5. Estimation of Evapotranspiration.
6. Land levelling - plane method from climatologically data.
7. Determination of irrigation efficiencies.
8. Problems on Border irrigation and Design of Basin irrigation.
9. Design of Furrow irrigation - problems.
10. Problems on Kennedy's and Lacey's theory
11. Design of under ground pipeline system.
12. Problems on Irrigation scheduling.
13. OFD works in command areas.
14. Design of surface drainage system.
15. Design of Sub-surface drainage system.
16. Field visit to command areas and observation of OFD works.

Text Books

1. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.
2. Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.

Reference Books

1. Luthin. J.N. 1966, Drainage Engineering, John Wiley and Sons, New York.
2. Murthy VVN. 2013. Land and Water Management Engineering. Kalyani Publishers, New Delhi.
3. Israelsen O W. and Hansen V. E and Stringham G. E. 1980. Irrigation Principles and Practice, John Wiley & Sons, Inc. USA.

18AT2019 MICRO IRRIGATION

Credits 2:0:1

Objectives

- To expose the students to the fundamental knowledge in Pumps for Irrigation use
- To understand the basic concepts for planning, design and management of micro irrigation system.
- To study the implementation of design in field level.

Outcomes

- The students will have technical knowledge and skills on Planning, design, operation and management of micro irrigation system.
- The students will gain knowledge on different methods of micro irrigation.
- The students will be able to design proper micro irrigation systems in the field.

Theory

WATER LIFTS AND PUMPS-Pump classification Variable displacement pumps–Centrifugal pump-Submersible pump- Vertical,Turbine pumps mixed flow – Jet and Airlift pumps-Pump selection and installation- Pump troubles and Remedies. PUMP VALVES-Types of valves- Pressure relief valve- Gate valve-Isolated valve- Non return valve- Butterfly valve- Solenoid valves- Automated control valve-selection, repair and maintenance. MICRO IRRIGATION CONCEPT AND APPLICATIONS-Micro irrigation- Comparison between Traditional and Micro irrigation methods -Merits and demerits of micro-irrigation system, Types and components of micro irrigation system- Scope and potential problem of micro irrigation - Low cost Micro irrigation Technologies- Gravity fed micro irrigation -Care and maintenance of micro-irrigation System- Economics of micro-irrigation system - Automation in micro-irrigation-Surge and cablegation irrigation- Greenhouse irrigation system. DRIP IRRIGATION DESIGN -Drip irrigation - Components- Dripper- types and equations governing flow through drippers- Wetting pattern- Chemigation application- Pump capacity-Installation- Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip irrigation. SPRINKLER IRRIGATION DESIGN -Sprinkler irrigation- Components and accessories - Hydraulic design - Sprinkler selection and spacing- Capacity of sprinkler system - types - Sprinkler performance- Sprinkler discharge- Water distribution pattern- Droplet size, filtering unit, fertigation - System maintenance

Practical

1. Study of different components of sprinkler irrigation system, Design and installation of sprinkler irrigation system
2. Determination of precipitation pattern, discharge and uniformity coefficient ,Cost economics of sprinkler irrigation system
3. Study of different components of drip irrigation, Design and installation of drip irrigation system
4. Study of different types of filters, Determination of filtration efficiency
5. Determination of rate of injection and calibration for chemigation/fertigation
6. Design of irrigation and fertigation schedule for crops
7. Evaluation of drip system, Determination of pressure discharge relationship and emission uniformity for given emitter, Cost economics of drip irrigation system.
8. Field visit to micro- irrigation system

Text Books

1. Suresh, R., “Principles of Micro-Irrigation Engineering”, Standard Publishers Distributors, New Delhi, 2010.
2. Michael, A.M., “Irrigation Theory and Practice”, Vikas Publishers, New Delhi, 2002.

Reference Books

1. Modi, P.N., and Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 1991.

2. Jack Keller and Rond Belisher., “Sprinkler and Trickle Irrigation”, Vannistrand Reinhold, New York, 1990.
3. Sivanappan R.K., “Sprinkler Irrigation”, Oxford and IBH Publishing Co., New Delhi, 1987.
4. Keller.J and D. Karmeli, “Trickle Irrigation Design”, Rainbird Sprinkler Irrigation Manufacturing Corporation, Glendora, California, USA.

18AT2020 PROCESS ENGINEERING FOR SPICES AND PLANTATION CROPS

Credits 2:0:0

Objectives

- To equip the students with processing spices and plantation crops.
- To understand the various processing steps involved for different plantation products, spices and aromatic and medicinal plants.
- To facilitate the utilization of various equipments used for processing.

Outcomes

- The students will be able to understand the various processes involved in the processing of spices and plantation crops.
- The students will apply their knowledge on the operation of various processing equipments.
- The students will be able to select proper equipments for various operations.

Importance and processing of spices – production and importance – stage of harvesting and harvesting methods - processing of major and minor spices – pepper, cardamom, chilli, turmeric, ginger, clove, nutmeg, vanilla – unit operations involved – equipments – principle and construction. Packaging, grading and quality analysis of spices- Cleaning and grading of spices - packaging and storage of spices – grading specifications – Agmark, ASTA, ESA specifications - processes involved in the manufacture of oleoresins and essential oils – quality analysis of spices and their derivatives. Processing of coffee, tea, cocoa and rubber – methods, process and equipment – value added products – grading and types - packaging and storage Processing of plantation crops- Processing of coconut, oilpalm, arecanut and cashew- production and importance – processing of coconut, oilpalm, arecanut, cashew– harvesting and stages of harvest – drying, cleaning and grading – production of value added products – packaging and storage of produces. Processing of medicinal crops- Importance of medicinal crops – production and export status - processing of medicinal crops - equipments used - principles and operations – active principles in various medicinal plants – application and uses - extraction methods

Text books

1. Pandey, P. H. 2002. Post Harvest Engineering of Horticultural Crops through Objectives. Saroj Prakasam, Allahabad.
2. Pruthi, J.S. 1998. Major Spices of India – Crop Management and Post Harvest Technology. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514.

Reference books

1. ASTA, 1997. Official analytical methods of the American Spice Trade Association, Fourth Edition.
2. Purselove, J.W., E.G.Brown, G.L.Green and S.R.J.Robbins. 1981. Cardamom – Chemistry. Spices, Vol. I, Tropical Agricultural Series, Longman, London, 1: 605.
3. Pruthi, J.S. 1980. Spices and Condiments: Chemistry, Microbiology and Technology. First Edition. Academic Press Inc., New York, USA. pp. 1-450.

18AT2021 APPLICATION OF RS AND GIS IN AGRICULTURE

Credits 2:0:0

Objectives

- To provide exposure to students in gaining knowledge on concepts and applications using Remote Sensing, GIS and GPS technologies.
- To acquire skills in storing, managing digital data for planning and development.
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources.

Outcomes

- The students will understand the remote sensing principles, remote sensing systems satellite data processing and available data products.
- The students will understand decision making process using DBMS and utilization of these advanced techniques in addressing the real world problems.
- The students will apply their skills on RS and GIS in agriculture, soil and water resources.

Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.

Text Books

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.

Reference Books

1. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective, Pearson Education Limited, UK.
2. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
3. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.
4. Sahu, K.C. 2008. Text Book of Remote Sensing and Geographic Information Systems. Atlantic Publishers and Distributors (P) Ltd., New Delhi.

5. Shultz, G.A. and E.T. Engman. 2000. Remote Sensing in Hydrology and Water Management. Springer, New York

18AT2022 PROCESS EQUIPMENT DESIGN

Credits 2:0:0

Objectives

- To equip the students to study the design aspects of the food processing equipments.
- To understand the relationship between process design and safety.
- To acquire knowledge on computer aided design of equipments

Outcomes

- The students will understand the various design aspects of the food processing equipments.
- The students will be able to design the process equipments.
- The students will be able to evaluate performance of process equipments.

Introduction on process equipment design, Application of design engineering for processing equipments, Design parameters and general design procedure, Material specification, Types of material for process equipments, Design codes, Pressure vessel design, Design of cleaners. Design of tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger, Design of belt conveyer, screw conveyer and bucket elevator, Design of dryers. Design of milling equipments. Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design.

Text Books

1. Mahajani, V. V. and Umarji, S. B., Process equipment design, Macmillan.
2. Bhattacharyya, B. C., Introduction to Chemical Equipment design, CBS Publishers and Distributors.
3. Geankoplis, C.J. 1997, Transport processes and Unit operations, Prentice Hall of India Publication, New Delhi
4. Rao, D. G. 2010, Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.

Reference Books

1. Brounsel and Young, 1993, Process Equipment Design.
2. James, M. More, 1976, Plant Layout and Design. MacMillian Publishing Co., New York.
3. Perry, R.H and C.H. Chilton, 1973, Chemical Engineering Hand Book. McGraw Hill, Tokyo.

18AT2023 DEVELOPMENT OF PROCESSED PRODUCTS

Credits 2:0:0

Objectives

- To equip the students to study the various processes involved in the development of products.
- To understand the correct unit operation for each product.
- To acquire knowledge on selection of suitable equipments for product development.

Outcomes

- The students will understand various processes involved in the development of products.
- The students will be able to identify suitable unit operation for processed product.
- The students will be able to evaluate selection of suitable equipments for product development.

Theory

Process design, Process flow chart with mass and energy balance, Unit operations and equipments for processing, New product development, Technology for value added products from cereal, pulses and oil seeds, Milling, puffing, flaking, Roasting, Bakery products, snack food. Extruded products, oil extraction and refining, Technology for value added products from fruits, vegetables and spices, Canned foods, Frozen foods, dried and fried foods, Fruit juices, Sauce, Sugar based confection, Candy, Fermented food

product, spice extracts, Technology for animal produce processing , meat, poultry, fish, egg products, Health food, Nutra-ceuticals and functional food, Organic food.

Text Books

1. Geankoplis C. J. Transport processes and unit operations, Prentice-Hall.
2. Rao, D. G. Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.
3. Norman N. Potter and Joseph H. Hotchikss. Food Science. Chapman and Hall Pub.
4. Acharya, K T Everyday Indian Processed foods. National Book Trust.

Reference Books

1. Mudambi Sumati R., Shalini M. Rao and M V Rajgopal. Food Science. New Age International Publishers.
2. Negi H.P.S., Savita Sharma, K. S. Sekhon. Hand book of Cereal technology. Kalyani Pub.

18AT2024 FARM MACHINERY DESIGN AND PRODUCTION

Credits 2:0:0

Objectives

- To equip the students about the importance of various farm machinery.
- To understand the design aspects of farm machinery and implements.
- To gain expertise on the design and production of farm machinery.

Outcomes

- The students will understand the importance of various farm machinery.
- .The students will be able to understand the design aspects of farm machinery and implements.
- The students will be able to design and evaluate farm machinery and implements.

Introduction to design parameters of agricultural machines & design procedure. Characteristics of farm machinery design. Research and development aspects of farm machinery. Design of standard power transmission components used in agricultural machines: mechanical & hydraulic units. Introduction to safety in power transmission. Application of design principles to the systems of selected farm machines. Critical appraisal in production of Agricultural Machinery; Advances in material used for agricultural machinery. Cutting tools including CNC tools and finishing tools. Advanced manufacturing techniques including powder metallurgy, EDM (Electro-Discharge Machining), Heat Treatment of steels including pack carburizing, shot pining process, etc. Limits, Fits & Tolerances, Jigs & Fixtures. Industrial lay-out planning, Quality production management. Reliability. Economics of process selection. Familiarization with Project Report.

Text Books

1. Richey, C.B. Agricultural Engineering Handbook.
2. Adinath M and AB Gupta. Manufacturing Technology.
3. Sharma PC and DK Aggarwal. Machine Design.

Reference Books

1. Narula V. Manufacturing process.
2. Singh S. Mechanical Engineer's Handbook.
3. Chakrabarti NR. Data book for Machine Design.

18AT2025 TRACTOR DESIGN AND TESTING

Credits 2:0:0

Objectives

- To acquaint the students about the various aspects of design of tractors.
- To equip with the testing procedures.
- To gain expertise on the design and testing of farm tractors.

Outcomes

- The students will gain knowledge on the various aspects of design of tractors.
- The students will be equipped with the testing procedures for tractors.
- The students will be able to design and test farm tractors.

Procedure for design and development of agricultural tractor, Study of parameters for balanced design of tractor for stability & weight distribution, traction theory, hydraulic lift and hitch system design. Design of mechanical power transmission in agricultural tractors: single disc, multi disc and cone clutches. Rolling friction and anti-friction bearings. Design of Ackerman Steering and tractor hydraulic steering. Study of special design features of tractor engines and their selection viz. cylinder, piston, piston pin, crankshaft, etc. Design of seat and controls of an agricultural tractor. Tractor Testing.

Text Books

1. Liljedahl J B & Others. Tractors and Their Power Units.
2. Raymond N, EA Yong and S Nicolas. Vehicle Traction Mechanics.
3. Maleev VL. Internal Combustion Engines.

Reference Books

1. Kirpal Singh. Automobile Engineering – Vol I and Vol II.
2. Richey C.B. Agricultural Engineering Handbook.
3. Mehta ML, SR Verma, SK Mishra, VK Sharma. Testing & Evaluation of Agricultural Machinery.

18AT2026 MECHANICS OF TILLAGE AND TRACTION

Credits 2:0:0

Objectives

- To understand the basic concepts on the mechanics of tillage and traction.
- To develop knowledge on power requirement for tillage.
- To study the various parameters in tillage operation.

Outcomes

- The students will understand the basic concepts the mechanics of tillage and traction.
- The students will gain on power requirement for tillage.
- The students will understand various parameters in tillage operation.

Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship, design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in soil dynamics and traction prediction equation. Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, tyre size, tyre lug geometry and their effects, tyre testing, soil compaction and plant growth, variability and application of GIS in soil dynamics.

Measurement of static and dynamic soil parameters related to tillage, soil parameters related to puddling and floatation, draft for passive rotary and oscillating tools, slip and sinkage under dry and wet soil conditions and load and fuel consumption for different farm operations; Weight transfer and tractor loading including placement and traction aids; Studies on tyres, tracks and treads under different conditions, and soil compaction and number of operations.

Text Books

1. Vandenberg and Gill. Tillage and Traction.
2. Liljedahl JB and others. Tractor and Power Units.
3. Daniel Hill. Fundamentals of Soil Physics.
4. Terzaghi K & Peck Ralph B. Soil Mechanics in Engineering Practices.

18AT2027 ERGONOMICS, HUMAN ENGINEERING AND SAFETY IN AGRICULTURAL MACHINERY

Credits 2:0:0

Objectives

- To impart basic knowledge in Ergonomics by understanding the fundamental Concepts
- To acquaint and equip with the ergonomic aspects in the design of farm machinery for more output and safety of human beings.
- To understand the basic concepts on human engineering and safety.

Outcomes

- The students will understand the fundamental concepts ergonomics and human engineering.
- The students will gain on safety aspects of machinery.
- The students will apply their knowledge in manufacturing industry.

Theory

Importance of ergonomics and its application in agriculture; Energy liberation in human body; Assessment of energy expenditure- direct calorimetry, Indirect calorimetry- Assessment by oxygen consumption; Techniques of measuring oxygen consumption; Assessment by heart rate and calibration; Assessment by subjective rating of perceived effort- Overall discomfort score and BPDS; Basal metabolism and work metabolism; Assessment of work load; Assessment of Individual's maximal work capacity. Anthropometry; Anthropometric data and measurement techniques; Anthropometric dimensions and strength parameters; Causes of variability of anthropometric data; Analysis of anthropometric data and use of percentiles. Biomechanics of motion. Vibration- hand arm vibration and whole body vibration, physiological effects; Noise and its physiological effects. Human factors in system development – concept of systems; basic processes in system development; performance reliability, human performance; Metabolic system, human energy machine, Human metabolism and work; Energy liberation in human body; Energy for muscle work; Assessment of energy expenditure- direct calorimetry, Indirect calorimetry; Techniques of measuring oxygen consumption; Assessment of work load; Information input process, visual displays, major types and use of displays, auditory and factual displays. Speech communications.

Text Books

1. Astrand, P.O and Rodahl, K.1977. Text book of work physiology, McGraw Hill, New York
2. Bridger, R.S,1995. Introduction to Ergonomics, McGraw Hill, New York
3. Dul J and Weerdmeester B.1993.Ergonomics for Beginners. A Quick Reference Guide. Taylor and Francis, London.
3. Mark S. Sanders and Ernest James McCormick. 1993. Human Factors in Engineering and Design. Mc Hill Corporation, New York.

Reference Books

1. Mathews J. and Knight A. A. 1971.Ergonomics in Agricultural Equipment Design.National Institute of Agricultural Engineering.

18AT2028 DRIP AND SPRINKLER IRRIGATION-DESIGN AND INSTALLATION

Credits 0:0:10

Objectives

- To understand the basic concepts on drip and sprinkler irrigation systems.
- To know the various components of drip and sprinkler irrigation systems.
- To acquire knowledge on the design and installation of drip and sprinkler irrigation systems.

Outcomes

- The students will understand the basic concepts on drip and sprinkler irrigation systems.

- The students will gain knowledge on the various components of drip and sprinkler irrigation systems.
- The students will be able to design and installation of drip and sprinkler irrigation systems.

Practical

Study of different components of sprinkler irrigation system; design and installation of sprinkler irrigation system; determination of precipitation pattern, discharge and uniformity coefficient; cost economics of sprinkler irrigation system; study of different components of drip irrigation; design and installation of drip irrigation system; determination of pressure discharge relationship and emission uniformity for given emitter; study of different types of filters and determination of filtration efficiency; determination of rate of injection and calibration for chemigation/fertigation; design of irrigation and fertigation schedule for crops; field visit to micro irrigation system and evaluation of drip system; cost economics of drip irrigation system.

Text Books

1. Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York .
2. Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.
3. Mane M.S and Ayare B.L. and MagarS.S.2006.Principles of Drip Irrigation systems, Jain Brothers, New Delhi.

Reference Books

1. Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.
2. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Pub. House New Delhi.
3. Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.

18AT2029 WATERSHED MANAGEMENT-CONCEPT AND STRATEGIES

Credits 0:0:10

Objectives

- To understand a comprehensive idea about watershed management.
- To know the various strategies for watershed management.
- To acquire knowledge on planning and execution of watershed management projects.

Outcomes

- The students will understand the basic concepts and ideas about watershed management.
- The students will gain knowledge on the various strategies for watershed management.
- The students will be capable of planning and execution of watershed management projects.

Practical

Exercises on delineation of watersheds using toposheets. Surveying and preparation of watershed map. Quantitative analysis of watershed characteristics and parameters.

Watershed investigations for planning and development. Analysis of hydrologic data for planning watershed management.

Water budgeting of watersheds. Prioritization of watersheds based on sediment yield index.

Study of functional requirement of watershed development structures.

Study of watershed management technologies.

Practice on softwares for analysis of hydrologic parameters of watershed. Study of role of various functionaries in watershed development programmes.

Techno-economic viability analysis of watershed projects. Visit to watershed development project areas.

Text Books

1. Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
2. Katyal, J.C., R.P. Singh, Shrinivas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
3. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.

Reference Books

1. Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
2. Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
3. Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.
4. Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.
5. Tideman, E.M. 1999. Watershed Management: Guidelines for India Conditions, Omega Scientific Publishers, New Delhi.

18AT2030 PRECISION FARMING IN THE SEMI-ARID AND HUMID TROPICAL ZONES

Credits 0:0:10

Objectives

- To understand the technology of precision farming.
- To know the various system concepts in precision farming.
- To acquire knowledge on planning and execution precision farming techniques using modern techniques.

Outcomes

- The students will understand the basic concepts and technology of precision farming.
- The students will gain knowledge on the various system concepts in precision farming.
- The students will be capable of planning and execution of precision farming techniques.

Practical

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc.

Introduction to GIS based precision agriculture and its applications. Introduction to sensors and application of sensors for data generation.

Database management. System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations.

Application to PERT and CPM for machinery system management

Solving problems related to various capacities, pattern efficiency, system limitation, etc.

Problems related to cost analysis and inflation and problems related to selection of equipment, replacement, break-even analysis, time value of money etc.

Text Books

1. Brahma Singh, Balraj Singh, NavedSabir and MurtazaHasan, 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
2. Donell Hunt, 2013. Farm Power and Machinery Management. 10th edition. MedTec Publishers, New Delhi.
3. Jana, B. L., 2008. Precision Farming. AgroTech Publishing Academy.

Reference Books

1. Kali CharanSahu, 2008. Text Book of Remote Sensing and Geographical Information Systems. Atlantic Publishers and Distributors Pvt Ltd.
2. K. RadhaManohar and C. Ignathinathane. 2015. Greenhouse Technology and Management. 2nd edition. B. S. Publications.

18AT2031 MINOR IRRIGATION AND COMMAND AREA DEVELOPMENT

Credits 0:0:10

Objectives

- To familiarize students about the basic concepts of Irrigation Management and command area development.
- To impart knowledge about the functioning of Irrigation projects and their performance aspects.
- To prepare the students on the activities of command area development and on farm irrigation activities.

Outcomes

- The students will understand the basic concepts of Irrigation Management and command area development.
- The students will gain knowledge about the functioning of Irrigation projects and their performance aspects.
- The students will be capable of planning and execution of command area development and on farm irrigation activities.

Practical

Factors affecting performance of irrigation projects; types of minor irrigation systems in India.

Lift irrigation systems: feasibility, type of pumping stations and their site selection, design of lift irrigation systems.

Tank Irrigation: grouping of tanks, storage capacity, supply works and sluices.

Command area development (CAD) programme- components, need, scope, and development approaches, historical perspective, command area development authorities-functions and responsibilities; on farm development works, reclamation works, use of remote sensing techniques for CAD works; water productivity: concepts and measures for enhancing water productivity; Farmers' participation in command area development;

Preparation of command area development layout plan; Irrigation water requirement of crops; Preparation of irrigation schedules; Planning and layout of water conveyance system; design of surplus weir of tanks; determination of storage capacity of tanks; design of intake pipe and pump house.

Text Books

1. Arora, K.R. 2001. Irrigation, Water Power and Water Resources Engineering. Standard Publishers Distributors, Delhi.
2. Garg S. K. 2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.

Reference Books

1. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ.House New Delhi.
2. Sahasrabudhe SR. 2011. Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015.

18AT2032 LANDSCAPE IRRIGATION DESIGN AND MANAGEMENT

Credits 0:0:10

Objectives

- To acquaint students about the basic concepts of landscape design.
- To impart knowledge about the design aspects of landscape.

- To provide hands on experience on the design and implementation of landscape irrigation and management.

Outcomes

- The students will attain the basic concepts of landscape design.
- The students will gain knowledge about the design aspects of landscape.
- The students will be capable of designing and execution landscape irrigation and management.

Practical

Conventional method of landscape irrigation- hose irrigation system, quick release coupling system and portable sprinkler with hose pipes.

Modern methods of landscape irrigation- pop-up sprinklers, spray pop-up sprinkler, shrub adopter, drip irrigation and bubblers; Merits and demerits of conventional and modern irrigation systems.

Types of landscapes and suitability of different irrigation methods, water requirement for different landscapes, Segments of landscape irrigation systems, Main components of modern landscape irrigation systems and their selection criteria.

Types of pipes, pressure ratings, sizing and selection criteria.

Automation system for landscape irrigation- main components, types of controllers and their application.

Design of modern landscape irrigation systems, operation and maintenance of landscape irrigation systems.

Determination of power requirement, pump selection. Irrigation scheduling of landscapes, Study of irrigation controllers and other equipments.

Use of AutoCAD in irrigation design: blocks & symbols, head layout, zoning and valves layout, pipe sizing, Pressure calculations etc.

Visit to landscape irrigation system and its evaluation.

Text Books

1. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ. House New Delhi.
2. Singh Neeraj Partap. 2010. Landscape Irrigation and Floriculture Terminology, Bangalore.
3. Smith Stephen W. Landscape Irrigation and Management. Amazon. com.

18AT2033 AGRO PROCESSING INDUSTRY - DESIGN AND MANAGEMENT

Credits 0:0:10

Objectives

- To acquaint students about the basic design concepts of agro industry.
- To impart knowledge about the design aspects of processing industry.
- To provide technical know-how on the preparation of project reports.

Outcomes

- The students will attain the basic concepts of agro industry.
- The students will gain knowledge about the design aspects of processing industry.
- The students will be capable of preparing project reports for setting various processing units.

Practical

1. Preparation of project report.
2. Preparation of feasibility report.
3. Salient features and layout of pre processing house.
4. Salient features and layout of Milk and Milk product plants- Evaluation of given layout.
5. Salient features, design and layout of modern rice mill.
6. Salient features, design and layout of Bakery and related product plant.
7. Study of different types of records relating to production of a food plant.
8. Study of different types of records relating to finance of a food plant.
9. Study of different types of records relating to marketing of a food business.

10. Brain storming and SWOT analysis to start a food processing business.

Text Books

1. Hall, H.S. and Rosen, Y.S. Milk Plant Layout. FAO Publication, Rome.
2. López Antonio. Gómez. Food Plant Design.
3. Robberts Theunis C. Food plant engineering systems by, CRCpress, Washington.
4. Maroulis Z B and Saravacos G D. Food plant economics. Taylor and Francis, LLC

Reference Books

1. Mahajan M. Operations Research. Dhanpat Rai and Company Private Limited, Delhi
2. Maroulis Z B. Food Process Design. Marcel Dekker, Inc ,Cimarron Road, Monticello, New York 12701, USA.

18AT2034 FARM MACHINERY AND POWER

Credits 1:0:1

Objectives

- To enable the students to understand the various farm implements and equipments.
- To impart knowledge about the application of implements for various operations.
- To provide technical know-how on working of equipments.

Outcomes

- The students will understand the various farm machinery.
- The students will gain knowledge about the use of farm machines.
- The students will understand the working of on working of equipments.

Theory

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

1. Study of different components of I.C. engine.
2. Learning of tractor driving,
3. Familiarization with operation of power tiller.
4. Familiarization with different types of primary and secondary tillage implements
5. Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter
6. Familiarization with different types of sprayers and dusters
7. Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

Text Books

1. Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
2. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 2010.
3. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005

Reference Books

1. Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi, 1996.
2. Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

18AT2035 SOIL AND WATER CONSERVATION

Credits 1:0:1

Objectives

- To enable the students to understand the concept of soil and water conservation.
- To impart knowledge about the various causes for soil erosion.
- To provide technical know-how on soil and water conservation measures.

Outcomes

- The students will attain the basic concepts of soil and water conservation.
- The students will gain knowledge about the various causes for soil erosion and prevention methods.
- The students will understand the various soil and water conservation measures.

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

1. Calculation of erosion index. Estimation of soil loss.
2. Measurement of soil loss.
3. Preparation of contour maps.
4. Design of grassed water ways.
5. Design of contour bunds.
6. Design of graded bunds.
7. Design of bench terracing system.
8. Problem on wind erosion.

Text Books

1. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
2. Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
3. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Reference Books

1. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
2. Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
3. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

18AT2036 SKILL DEVELOPMENT TRAINING-I (STUDENT READY)

Credits 0:0:5

Objective:

To train the students on skill development.

Summer break after IV semester -Student READY Skill Development Training -I for five weeks in the summer break after IV semester with a credit load of 0+5 credit hours.

18AT2037 10-WEEKS INDUSTRIAL ATTACHMENT/INTERNSHIP(STUDENT READY)

Credits 0:0:10

Objective:

To impart training in industries.

Semester VII - Industrial attachment of 10 weeks with local industries.

18AT2038 10-WEEKS EXPERIENTIAL LEARNING ON CAMPUS (STUDENT READY)

Credits 0:0:10

Objective:

To conduct trials in the field for onsite learning..

Semester VII - On campus Experiential Learning Program of 10 weeks with a credit load of 0+10 credit hours by selecting subjects given in the syllabus.

18AT2039 SKILL DEVELOPMENT TRAINING-II (STUDENT READY)

Credits 0:0:5

Objective:

To train the students on skill development.

Summer break after VI semester- Student READY Skill Development Training -II for five weeks in the summer break after VI semester

18AT2040 EDUCATIONAL TOUR

Credits 0:0:2

Objective:

To expose the various research organizations to gain on the field knowledge.

Visit to places of interest in Tamil Nadu & Pondicherry States related to the subjects taught in Farm Machinery and Power, soil and Water Conservation Engineering, Food and Agricultural Process Engineering, Bio Energy and Agricultural Structures, Viz.,

18AT2041 PROJECT PLANNING AND REPORT WRITING

Credits 0:0:10

Objective:

To prepare the student for project and field study of selected topic.

Identification of problem – literature collection – fabrication of equipments – land preparation – preliminary testing of equipments / layout of irrigation trails – parametric data collection.

18AT2042 RENEWABLE ENERGY AND GREEN TECHNOLOGY

Credits 1:0:1

Objectives

- To enable the students to understand the concept of renewable energy.
- To impart knowledge about the various green technology techniques.
- To provide technical know-how on renewable energy measures.

Outcomes

- The students will gain the basic knowledge of renewable energy.
- The students will design renewable energy structures.
- The students will analyze the green energy techniques.

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

Text Books

1. Rai G.D. 2013. Non-conventional Sources of energy. Khanna Publishers. Delhi.
2. Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.
3. Chawla, O.P. 1986. Advances in biogas Technology, IARI, New Delhi.
4. Sukhatme, S.P. and Nayak, J.K. 2012. Solar Energy: Principles of Thermal Collection and Storage, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi

Reference Books

1. Mathur, A.N. and Rathore N.S. 1992. Biogas production, management and utilization. Himanshu Publication. Delhi.
2. Mital, K.M., 1996, Biogas systems; Principles and applications, New Age International (P) ltd. Publishers, New Delhi.
3. Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
4. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

18AT2043 PROTECTED CULTIVATION AND SECONDARY AGRICULTURE

Credits 1:0:1

Objectives

- To enable the students to know the basics of protected cultivation.
- To impart knowledge about the various techniques involved in protected cultivation.
- To provide technical know-how on secondary agriculture.

Outcomes

- The students will understand the basic concepts of protected cultivation.

- The students will design improved protected cultivation measures.
- The students will analyze cost economics in secondary agriculture.

Theory

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant.

Text Books

1. Brahma Singh, Balraj Singh, NavedSabir and MurtazaHasan, 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
2. Donell Hunt, 2013. Farm Power and Machinery Management. 10th edition. MedTec Publishers, New Delhi.
3. Jana, B. L., 2008. Precision Farming. AgroTech Publishing Academy.

Reference Books

1. Kali CharanSahu, 2008. Text Book of Remote Sensing and Geographical Information Systems. Atlantic Publishers and Distributors Pvt Ltd.
2. K. RadhaManohar and C. Ignathinathane. 2015. Greenhouse Technology and Management. 2nd edition. B. S. Publications.

18AT2044 WATER QUALITY AND MANAGEMENT MEASURES

Credits 2:0:0

Objectives

- To enable the students to know the basics of water and its quality.
- To impart knowledge about the various techniques involved in water quality testing.
- To provide technical know-how on managing water quality.

Outcomes

- The students will understand the basics of water quality.
- The students will find measures to solve water quality..
- The students will design methods to find solutions for water testing.

Theory

Natural factors affecting quality of surface water and groundwater, water quality objectives in relation to domestic, industrial and agricultural activities, drinking water quality standards, irrigation water quality classification as per USSL and All Indian Coordinated Research Project (AICRP) criteria, point and non-point water pollution sources, water contamination due to inorganic and organic compounds, water contamination related to agricultural chemicals, food industry, hydrocarbon and synthetic organic compounds. Arsenic and fluoride contamination in groundwater and remedial measures, water

decontamination technologies, cultural and management practices for using poor quality water for irrigation.

Text Books

1. Gray, N.F. Water Technology. Raj Kamal Electric Press, Kundli, Haryana.
2. Hussain, S.K. 1986. Text Book of Water Supply and Sanitary Engineering. Oxford & IBH Publishing Co. New Delhi.
3. Manahan, S.E. 2009. Fundamentals of Environmental Chemistry. CRC Press, New York.

Reference Books

1. FAO. 1996. Control of water pollution from agriculture - FAO irrigation and drainage paper 55.
2. McGauhey, P.H. 1968. Engineering Management of water quality. McGraw Hill Book Company, New York.
3. Minhas, P.S. and Tyagi, N.K. 1998. Guidelines for irrigation with saline and alkali waters. Bull. No, 1/98, CSSRI, Karnal, p. :36.
4. Punmia, B.C. and Lal, P.B.B. 1981. Irrigation and water power engineering. Standard Publishers Distributors, Delhi.

18AT2045 BASICS OF MATLAB PROGRAMMING

Credits 2:0:0

Course objectives:

- To understand the fundamentals of MATLAB.
- To impart basic knowledge on simulation and modeling.
- To know the importance of dynamics and control.

Course outcomes:

- The students will understand the role of MATLAB programming.
- The students will study various methods of plotting.
- The students will compute solutions for various properties for various water and environmental problems.

Theory

Basic Matlab programming: algorithm, pseudo-code, flow chart, interface, data types- expressions, constants, variables, assignment statement, arrays-control statements: if, else, then, while, for loop, nested loop, switch/case- functions and scripts- formatted input and output statements-reading from and writing to a text file-sorting-basic plotting: 2D and 3D plots, figures and sub plots - graphics handling, objects-application examples in environmental and water resources engineering.

Text Books

1. Holy, M, MATLAB for Engineers, Prentice Hall, 3rd Edition, 2012.
2. Rudra, P, Getting started with MATLAB: AQuick Introduction for Scientists and Engineers, Oxford University Press, 2010.

Reference Books

1. Duane, C.H, Mastering MATLAB, Pearson Education Inc., 2012.
2. Amos, G, MATLAB: An Introduction with Applications, 4th Edition, 2011

18AT2046 FARM MECHANIZATION – FIELD STUDY

Credits 0:0:10

Objectives

- To impart basic knowledge in farm mechanization.
- To acquaint and equip with the farm machinery for different crops.
- To understand the economics of using agricultural machinery.

Outcomes

- The students will understand the various farm machinery used in farms.
- The students will gain knowledge on usage aspects of farm mechanization.
- The students will apply their knowledge in mechanization of the farm.

Practical

Familiarization with different farm implements and tools.

Problems on machinery management.

Study of primary and secondary tillage machinery – construction, operation, adjustments and calculations of power and draft requirements.

Study of sowing and planting equipment – construction, types, calculation for calibration and adjustments.

Study of transplanters – paddy, vegetable, etc.

Familiarization with plant protection and intercultural equipment.

Study of sprayers, types, functional components.

Study of dusters, types and functional components.

Study of various types of mowers, reaper, reaper binder.

Familiarization with threshing systems, cleaning systems in threshers.

Calculations of losses in threshers.

Familiarization with functional units of Grain combines and their types.

Text Books

1. Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
2. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 2010.
3. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005

Reference Books

1. Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi, 1996.
2. Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

18AT2047 TESTING OF FARM MACHINERY AND EQUIPMENTS**Credits 0:0:10****Objectives**

- To impart basic knowledge in testing of farm machinery.
- To acquaint and equip the economics of farm equipments.
- To understand the methods of testing various farm machinery.

Outcomes

- The students will understand the various methods of testing.
- The students will gain knowledge on application of testing farm equipments.
- The students will apply their knowledge in farm machinery testing.

Practical

Problems on machinery management, Study of primary and secondary tillage machinery –calculations of power and draft requirements. Study of sowing and planting equipment –calculation for calibration and adjustments. Study of transplanters – paddy, vegetable. Familiarization with plant protection and intercultural equipment. Study of sprayers, types, functional components. Study of dusters, types and functional components. Familiarization with threshing systems, cleaning systems in threshers- Calculations of losses in threshers. Testing of Grain combines and harvesters.

Text Books

1. Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
2. Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 2010.
3. Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005

Reference Books

1. Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi, 1996.
2. Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.

18AT2048 VALUE ADDITION OF INDIGENOUS FRUITS AND VEGETABLES**Credits 0:0:10****Objectives**

- To acquaint students about the basics of value addition of fruits and vegetables.
- To impart knowledge about methods of preserving fruits and vegetables.
- To provide technical know-how on the preparation of project reports for preservation techniques.

Outcomes

- The students will attain the basic concepts of value addition.
- The students will gain knowledge about the methods of processing indigenous fruits and vegetables.
- The students will be capable of preparing project reports for setting processing units for indigenous fruits and vegetables.

Practical

Selection of indigenous fruits and vegetables. .
Study of their quality attributes.
Study of physical and chemical parameters.
Preparation of processing techniques.
Preparation of project reports for value addition.

Text Books

1. Arthey, D. and Ashurst, P. R. 1966. Fruit Processing. Chapman and Hall, New York.
2. Pandey, R.H. 1997. Postharvest Technology of fruits and vegetables (Principles and practices). Saroj Prakashan, Allahabad.

Reference Books

1. Sudheer, K P. and Indira, V. 2007. Post Harvest Engineering of horticultural crops. New india Publishing House.
2. Pantastico, E.C.B. 1975. Postharvest physiology, handling and utilization of tropical and subtropical fruits and vegetables AVI Pub. Co., New Delhi.

AGRICULTURE

LIST OF COURSES

Sl. No.	Course Code	Name of the Course	Credits
1	17AG1001	Principles of Agronomy and Agricultural Heritage	3:0:1
2	17AG1002	Agricultural Microbiology	3:0:1
5	17AG1003	Fundamentals of Plant Biochemistry	3:0:1
6	17AG1004	Agricultural Meteorology	3:0:1
7	17AG1005	Irrigation Water Management	3:0:1
8	17AG1006	Crop Physiology	3:0:1
9	17AG1007	Principles of Genetics and Genomics	3:0:1
10	17AG1008	Principles of Agricultural Economics	3:1:0
11	17AG1009	Dimensions of Agricultural Extension	2:0:1
12	17AG1010	Principles of Horticultural Sciences	2:0:1
13	17AG1011	Introduction to Soil Science	3:0:1
14	17AT1001	Introduction to Agriculture	2:0:0
15	17HO1001	Botany of Horticultural Crops	3:0:0
16	17HO1002	Propagation of Horticultural Crops	2:0:1
17	17HO1003	Production Technology of Tropical Fruit Crops	2:0:1
18	17HO1004	Production Technology of Tropical Vegetable Crops	2:0:1

17AG1001 PRINCIPLES OF AGRONOMY AND AGRICULTURAL HERITAGE

Credits: 3:0:1

Course Objectives:

- To have a general understanding on the crops and their classification
- To apprise the student about planting of crops and application of fertilizers
- To familiarize the students with the traditional agricultural practices in the world

Course outcome:

- Basics of crop characteristics and classification understood
- Fundamentals of soil-water-plant relationship studied
- Best traditional practices learned

Description:

Meaning, definition and scope of agronomy. Relationship with other disciplines / divisions of agronomy- Classification of crop / plants based on the intensity of cultivation, uses, life span, growth habit, and climatic response and/or habitat. Agronomic classification of crops. Botanical classification. Category of cultivars - classification of crops based on special purpose. Growth - definition - factors affecting growth - Crop yield contributing characters - harvest index - Seed - definition - characteristics of good quality seed - vegetative propagation in field crops - setts, slips, tubers, and rhizomes - methods of sowing / planting - planting geometry and its effect on growth and yield - Tillage definition - objectives - types of tillage- tillage implements - tillage - characteristics of good tillage - Soil productivity and fertility- Crop nutrition - nutrients - classification - Nutrient sources - organic manures - fertilizers - biofertilizers - Integrated Nutrient Management Agricultural Heritage: history of agriculture in India - Traditional water lifting devices-best traditional water harvesting practices. Ancient irrigation structures in India-Water management during Indus valley civilization period and agriculture in Saptha saindhava.

Practical:

Visit to crop field and identification of crops- Study on field preparation: tillage implements - ploughs, harrows and cultivators - Practice of ploughing; Practice of puddling; Study of seeding equipment. Different methods of sowing crops-direct seeding: broadcasting, dibbling and drilling-transplanting. Identification of manures and fertilizers - organic manures: bulky and concentrated-fertilizers: Straight, complex and mixed fertilizers - Fertilizer recommendation and calculation of doses for rice, coconut, cassava, banana and cowpea. Methods of application of fertilizers broadcasting, placement, foliar application and fertigation - Visit to experimental plots to study design and layout - yield estimation of crops.

References:

1. Vishwakarma, A.K., Gopal Kumar, Brajendra, 2015, Agronomy A to Z, Biotech Books, New Delhi
2. Patil, J.V. et. al., 2015, Key Notes on Agronomy, Daya Publishing House, Delhi
3. Balasubramaniyan, P and Palaniappan, S.P. 2001. Principles and Practices of Agronomy. AgroBios (India) Ltd., Jodhpur
4. Brady, N.C. and Well, R.R. 2002. The Nature and Properties of Soils (13th ed.). Pearson Education, Delhi
5. De, G.C. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi
6. Gupta, O.P. 2000. Weed Management - Principles and Practices. Agrobios (India) Ltd., Jodhpur
7. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7th ed.). Pearson Education, Delhi
8. KAU [Kerala Agricultural University]. 2016. Package of Practices Recommendations. Kerala Agricultural University, Thrissur
9. Rao, V.S. 2000. Principles of Weed science. Oxford & IBH Publishing Co. New Delhi
10. Reddy.T.Y and Reddy, G.H.S. 1995, Principles of Agronomy, Kalyani Publishers, Ludhiana
11. Reddy.S.R. 1999. Principles of Agronomy, Kalyani Publishers, Ludhiana
12. Sankaran, S. and Subbiah Mudaliar, V.T. 1991. Principles of Agronomy. The Bangalore Printing & Publishing Co., Bangalore
13. Thomas, C.G. and Abraham, C.T. 1998. Common Weeds of Rice Ecosystem and Their Management. Kerala Agricultural University, Thrissur
14. Thomas, C.G. and Abraham, C.T. 2007. Methods in Weed Science. Kerala Agricultural University, Thrissur

17AG1002 AGRICULTURAL MICROBIOLOGY**Credits: 3:0:1****Course Objectives:**

- To learn about germ theory of the diseases
- To have a general understanding on soil microbiology
- To study the beneficial use of micro-organisms

Outcome:

- Germ theory studied
- Action of microbes in soils understood
- Beneficial use of microbes learned

Description:

Introduction to microbial world - history of microbiology – Spontaneous generation theory – prokaryotic and eukaryotic microorganisms – bacterial cell - morphology and structure - germ theory of disease - protection against infections – applied areas of microbiology - metabolism in bacteria - ATP generation - chemoautotrophy, photoautotroph, respiration, fermentation – bacteriophages - structure and properties of bacterial viruses – lytic and lysogenic cycles - viroids, prions. Bacterial genetics – gene expression - genetic recombination - transformation, conjugation and transduction. Genetic engineering: plasmids, episomes - genetically modified organisms. Soil microbiology: microbial groups in soil - microbial transformations of carbon, nitrogen, phosphorus and sulphur - biological nitrogen fixation - microflora of rhizosphere and phyllosphere microflora - microbes in composting - microbiology of water; Microbiology of food: role of microbes in fermentation - microbial spoilage and principles of food preservation. Beneficial microorganisms in agriculture - biofertilizer (bacterial, cyanobacterial and fungal) - microbial insecticides - microbial agents for control of plant disease – biodegradation - biogas production - biodegradable plastics. Plant microbe interactions: beneficial – symbiotic, associative and non-symbiotic – PGPR – plant pathogens. Endomycophytic bacteria

Practical

Familiarization with instruments, materials, glassware etc. in a microbiology laboratory - practice of aseptic methods: I - evaluation of aseptic technique with nutrient broth tubes. II- evaluation of aseptic technique with a nutrient agar plate - methods of sterilization and preparation of media I- preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stab; II- sterilization of glassware by dry heating; III - sterilization of nutrient broth by filtration - plating methods for isolation and purification of bacteria I - isolation of bacteria by streak plate method. II - isolation of aerobic spore forming bacteria by enrichment using streak plate method. III -

checking of purity of a bacterial culture by streak plating method - identification of bacteria by staining methods and biochemical tests: I- morphological examination of bacteria by simple and differential staining. II – different biochemical tests for identification of bacterial culture; enumeration of bacteria: I - enumeration of bacteria by stain slide method. II- enumeration of bacteria by most probable number method. III -enumeration of bacteria by pour plate method and spread plate method.

References

1. Ram Chandra, 2015, Microbial Biodiversity in Sustainable Agriculture, Daya Publishing House, Delhi
2. Lakhman, H. C., 2015, Recent Trends in Microbiology Mycology and Plant Pathology, Daya Publishing House, Delhi
3. Pelczar, M.J., Chan, E.C.S.and Kreig, N.R. 1993. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
4. Stanier ,R.Y., Ingraham, Wheelis ,M.G. and Paintor, P.R. 1986.The Microbiology World. Prentice Hall, New Jersey.
5. Tauro, P., Kapoor, K.K. and Yadav, K.S. 1989. An Introduction to Microbiology. Wiley Publications, New Delhi.
6. Alexander, M. 1985. Introduction to Soil Microbiology. John Wiley & Sons, New York.
7. Subba Rao, N.S. 1999. Biofertilizers in Agricultural and Agroforestry. Oxford & IBH, New Delhi.
8. Deepak Kumar Verma, Balaram Mohapatra, Shikha Srivastava, Sashi kanta Dash, Ajay Veer Singh, Bavita Asthir, Dinesh Narayan Bharadwaj, 2013, Objective Agricultural Microbiology at a Glance, First Edition, Scientific International (Pvt.) Ltd., Delhi

17AG1003 FUNDAMENTALS OF PLANT BIOCHEMISTRY

Credits: 3:0:1

Course Objectives:

- To impart knowledge on plant cells, proteins and biosynthesis
- To educate on the importance of proteins, enzymes and lipids
- To impart knowledge on biosynthesis

Course Outcome:

- Basic understanding imparted on plant cells, proteins, industrial applications and biosynthesis
- The students learnt the importance of plant cells
- Basics of protein enzymes and lipids understood
- Familiarized with the application of bio-molecules in industry

Description:

Biochemistry – introduction and importance. Plant cell, cell wall and its role in livestock, food and paper industries. Bio-molecules – Structure, properties and applications: Amino acids, peptides and proteins –Plant proteins and their quality. Enzymes –Factors affecting the activity, classification, immobilisation and other industrial applications. Lipids –Acyl lipids, their industrial application in soaps, detergents, paints, varnishes, lubricants, adhesives, plastics, nylon, bio-diesel, biodegradable plastics etc. Carbohydrates; Nucleotides and Nucleic acids. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. General reactions of amino acid degradation. Biosynthesis – carbohydrates, lipids, proteins and nucleic acids. Metabolic regulation. Secondary metabolites, Terpenoids, Alkaloids, Phenolics and their applications in food and pharmaceutical industries.

Practical

Amino acid models (atomic); Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by T.L.C.; Extraction of oil from oil seeds; Estimation of fatty acids by G.L.C.; Models of sugars, sucrose and starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

References

1. Dutcher, Raymond Adams et. al., 2014, Biotech Books, New Delhi

2. Chavan, U. D., Patil, J. V., 2015, Key Notes on Biochemistry and Biotechnology, Daya Publishing House, Delhi
3. Conn, E.E and Stumpf, P.K. 1989. Outline of Biochemistry. Wiley Eastern Ltd., New Delhi.
4. Frank M. Mallette, Paul M. Althouse and Carl O. Glagett. 1960. Biochemistry of Plants and Animals. Published by Wiley Pvt Ltd., New Delhi
5. Jain, J.L. 2001. Fundamentals of Biochemistry. 5th Edn., S.Chand & Company, New Delhi
6. Lehninger, A. 1984. Principles of Biochemistry. Published by CBS Publishers and Distributors, New Delhi
7. Mazur, A and Harrows, B. 1971. Textbook of Biochemistry. W.B. Sanders Publications, New Delhi
8. Metha, S.L, Lodha, M.L and Sane, P.V. 1993. Recent Advances in Plant Biochemistry. ICAR, New Delhi
9. Hans-Walter Heldt ,2005, Plant biochemistry, Academic Press

17AG1004 AGRICULTURAL METEOROLOGY

Credits: 3:0:1

Course Objectives:

- To understand the role of meteorology in plant science
- To learn climatic parameters and their measurements
- To study the fundamentals of global warming and climate change

Course Outcome:

- Agro-climatic factors understood
- Measurement and estimation techniques for climatic parameters learned
- Fundamentals of global warming and climate change studied

Description:

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 - 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. Cloud classification and measurements - cloud seeding - Rainfall and its mechanisms - forms and types of rainfall – Indian monsoons - southwest monsoon - northeast monsoon - monsoon variability across Tamil Nadu and India - Rainfall over India and Tamil Nadu- 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 - weather and climate related natural disasters, risk and management - Climate change and global warming - weather modification - Introduction to remote sensing.

Practical:

Meteorological and agrometeorological stations - Types of agricultural meteorological stations - Selection of site and layout of agro meteorological stations - Measurement of atmospheric variables - Air temperature and soil temperature - Relative humidity - Determination of vapour pressure - Measurement of wind speed and direction - Measurement of rainfall and open pan evaporation - Installation of soil thermometers and measurement - sunshine recorder and measurement of sunshine duration - Automatic Weather Station - recording of weather data - tabulation - processing and presentation - Preparation of crop weather calendars.

References:

1. Khanna, D R et al, 2013, Climate Change Effects on Agriculture and Economy, Biotech Books, New Delhi
2. Das.P.K. 1968. The Monsoons. NBT, New Delhi
3. Khadekar, S.R. 2001. Meteorology. Agromet Publishers, Nagpur
4. Mavi, H.S. 1986. Introduction to Agrometeorolgy. Oxford & IBH Publishing Co. New Delhi
5. Menon, P.A. and Rajan, C.K. 1989. Climate of Kerala. Classic Publishing House, Kochi
6. Prasada Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Second Edition. Kerala Agricultural University, Thrissur.

7. Sachati, A.K. 1985. Agricultural Meteorology – Instruction-cum-practical manual, NCERT, New Delhi
8. Varshney, M.C. and Balakrishna Pillai, B. 2003. Textbook of Agricultural Meteorology. ICAR, New Delhi.
9. Venketaraman, S. and Krishnan, A. 1992. Crops and Weather. ICAR, New Delhi.
10. Wilsie, P.C. 1961. Crop Adaptation and Distribution. Eurasia Publishing House (P) Ltd., New Delhi

17AG1005 IRRIGATION WATER MANAGEMENT

Credits: 3:0:1

Course Objectives:

- To introduce soil-water-plant relationships in the context of irrigation
- To introduce the concepts of scheduling, water distribution, design and methods of irrigation
- To have practical knowledge on drip and sprinkler irrigation

Course Outcome:

- Students learnt estimation of crop water and irrigation requirements
- Students enabled in implementing irrigation schemes
- Students capacitated in selecting appropriate irrigation methods

Description:

Irrigation: need, importance, impact on development of humanity, development in India; National Water Policy and irrigation. Canal, tank irrigation. Crop water requirement of different crops; infiltration; soil-water-plant relationships; soil quality; Duty of water; supply and demand based water distribution; irrigation scheduling; frequency and interval of irrigation; Warabandhi system. Different irrigation methods: border irrigation, furrow irrigation, basin irrigation, drip and sprinkler irrigation; irrigation methods: consideration of slope, soils and climate, evaluation, wetting pattern and planting techniques, efficiency; case studies.

Practicals

Visit to farm and demonstration of basin, drip and sprinkler irrigation in the field; conducting pumping test; planning, design and estimation related to drip irrigation.

Reference

1. Lamm, Freddie R., et. al., 2013, Microirrigation for Crop Production: Design Operation and Management, Bio-Green Elsevier (Exc)
2. Majumdar D. P., 2005, Irrigation Water Management: Principles and Practices, Prentice Hall of India, New Delhi
3. Dewasish Choudhary, 2008, Irrigation Theory and Practice, Anmol Publications Pvt Ltd
4. Michael A.M., 1999, Irrigation Theory and Practice, Vikas Publishing House, New Delhi
5. Van den Bosch B.E., Hoevenaars J. and Broumer C., 1999, Irrigation Water Management Training Manual, No.1 to 7, FAO, Rome.
6. Asawa G.L., 1996, Irrigation Engineering, New Age International Private Limited, New Delhi.

17AG1006 CROP PHYSIOLOGY

Credit 3:0:1

Course Objectives:

- To introduce the students to seed physiology and biochemical changes during seed development.
- To understand growth and growth characteristics
- To impart knowledge on basic nutriophysiology

Course Outcome:

- Knowledge gained on different aspects of seeds
- Study growth pattern of plants
- Learned nutriophysiology

Description:

Seed physiology, seed structures - morphological, physiological and biochemical changes during seed development - physiological maturity, harvestable maturity, seed viability and vigour. Methods of testing seed viability and vigour, germination, utilization of seed reserves during seed germination. Morphological, physiological and biochemical changes during seed germination. Measurement of growth, growth analysis growth characteristics. Crop water relations. Transpiration - significance. Photosynthesis, energy synthesis, photosynthetic efficiency, photorespiration. Brief account of growth respiration and maintenance respiration, alternate respiration. Physiology of nutrient uptake – functions of plant nutrients – deficiency and toxicity symptoms of plant nutrients – foliar nutrition – hydroponics. Post harvest physiology – Factors influencing seed storage (ISTA standards). Fruit ripening - metamorphic changes – climateric and non-climateric fruits.

Practicals:

Study of plant cells; Preparation of standard solutions; Structure and distribution of stomata, imbibition, osmosis and plasmolysis, measurement of root pressure, rate of transpiration; Separation of photosynthetic pigments through paper chromatography; Estimation of chlorophyll; Rate of transpiration; Photosynthesis, respiration, tissue test for mineral nutrients; Estimation of RWC; Measurement of rate of photosynthesis by IRGA; Estimation of hormone using bioassay.

References

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2. Devlin R.M. 1979. Plant Physiology, II Edn, Affiliated East West Press, New Delhi
3. Noggle G.R. & Fritz G.J. 1992. Introductory Plant Physiology, II Edn. Prentice Hall of India (P) Ltd., New Delhi
4. Milthroe, F.L. and Marby, J. 1979. An Introduction to Crop Physiology, Cambridge University Press, London
5. Devlin R. M. and Witham F. H. 1983. Plant Physiology, 4th Edn., CBS Publishers and Distributors, New Delhi
6. Gupta .N.K and Sunita Gupta.2002. Plant Physiology. Oxford & IBH Publishing Co.Pvt.Ltd.NewDelhi.
7. Malick, C.P and Srivastava, A.K.. 2000, Text book of Plant Physiology, Kalyani Publishers, New Delhi.
8. Taiz, Land Zeiger, E. 2014. Plant Physiology. Sinauer Associates Publishers Inc., Publishers

17AG1007 PRINCIPLES OF GENETICS AND GENOMICS**Credits 3:0:1****Course Objectives:**

- To impart knowledge on structure of genes and type of genes action
- To make the student understand chromosome, structure, morphology, number and types
- To learn basics of DNA, RNA and fundamentals of transcription, translation, genetic code and outline of protein synthesis

Course Outcome:

- Mendel's laws and types of gene action studied
- Basics of DNA, RNA and fundamentals of transcription, translation, genetic code and protein synthesis learned, as also evolution of different crop species understand
- Chromosomal aberrations and evolutions of different crop species studied

Description:

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. Mutation and its features; Methods of inducing mutations and CIB technique. Fine structure of gene; gene expression regulation and differential gene activation; Ultra structure of cell and cell organelles and their functions. Study of chromosome structure - morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis - their significance and differences. DNA - its structure and function – types of DNA – modes of replication and repair. RNA - its structure, function and types; transcription, translation, genetic code and outline of protein synthesis. Linkage and crossing: types of linkage, over estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like cotton, wheat, tobacco, triticale and brassicas. Structural chromosomal aberrations.

Practicals:

Microscopy-Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis and meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis, Interaction of factors; Epistatic factors, Supplementary factors and duplicate factors; complementary factors; additive factors and inhibitory factors.

References:

1. Singh, Upadhyaya Bisht, 2015, Genetic and Genomic Resources of Grain Legume Improvement, Elsevier-Biogreen
2. Sharma, Ramnivas, 2006, Agricultural Science: Gene Sequencing and Mapping, Biotech Books, New Delhi
3. Acquaah, G. 2007. Principles of Plant Genetics and Breeding, Blackwell Publishing Co., New Delhi
4. Gardner, J., Simmons, M. J. and Snustad, D. P. 2009. Principles of Genetics (8th Ed.). Wiley India Pvt. Ltd., New Delhi.
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6. Krebs, J. E., Goldstein, E. S. and Kilpatrick, S. T. 2014. Lewin's Genes.XI . Jones and Bartlett India Pvt. Ltd., New Delhi.
7. Pierce, B. A. 2014. Genetics - A Conceptual Approach, W.H. Freeman & Company, California
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9. Singh, P. 1995. Elements of Genetics. Kalyani Publishers, Ludhiana.
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11. Strickberger, M.W.1996. Genetics (3rd Ed.). Mc Millan Publishing Co., New Delhi.
12. Swanson, C.P., Merz, T. and Young, J. 1975. Cytogenetics. Prentice Hall of India Pvt. Ltd., New Delhi.
13. Winchester, A.M.1967. Genetics (3rd Ed.). Oxford and IBH Publishing Co., New Delhi.

17AG1008 PRINCIPLES OF AGRICULTURAL ECONOMICS**Credits: 2:1:0****Course Objectives:**

- To highlight the importance of agricultural economics
- To familiarize with different theories and laws in economics applicable to agriculture
- To learn the basics of public finance and welfare economics in relation to agriculture

Course Outcome:

- Basics of agricultural economics and fundamentals of welfare economics studied
- Theories and laws applicable to agriculture economics learned
- Gained knowledge on public finance and welfare economics in relation to agriculture

Description:

Economics: Meaning, definition, subject matter. Divisions of economics -importance of economics. Agricultural economics - meaning, definition- Basic concepts -goods, service, utility, value, price, wealth, welfare. Wants - meaning, characteristics, classifications of wants, importance. Theory of consumption; Law of diminishing marginal utility: meaning, definition, assumption, illustration, limitations, law of equimarginal utility-importance. consumer surplus: meaning, definition, importance. Demand: meaning, definition, kinds of demand, demand schedule, demand curve, law of demand, extension and contraction vs increase and decrease in demand. Elasticity of demand: types of elasticity of demand, degrees of price elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand, importance of elasticity of demand. Supply: meaning, supply function-law of supply - factors influencing Production: meaning, factors of production- land, labour, capital, organization, entrepreneurship.- Distribution: rent, wages, interest, profit. National income: definition and concepts. Public finance: meaning. Public resource: meaning – sources. Taxation types; Public expenditure: meaning, principles, Money: meaning – evolution. Inflation: definition, types of inflation.- Welfare economics: meaning and basic concepts.

References:

1. Sharma, Pawan Kumar, Dwivedi, Sudhakar, Bhat, Anil, 2014, Practicals in Agricultural Economics, Daya Publishing House, Delhi
2. Chavan, U.D. et. al., 2015, Key Notes on Agricultural Economics, Business Management and Statistics (PB), Daya Publishing House, Delhi
3. Dewett, K.K. 2005. Modern Economic Theory. S. Chand, New Delhi.
4. Dewett, K.K., Verma. 2004 Elementary Economic Theory, S.Chand, New Delhi
5. Jhingam, M.L. 2001. Micro Economic Theory. Konark Publishers, New Delhi
6. Kenneth, E.B. 1941. Economic Analysis. Harper and Row, New York.
7. Reddy, S., Raghuram, P., Neelakantan, T.V., Bhavani D. I. 2004. Agricultural Economics, Oxford and IBH Publishers, New Delhi.

17AG1009 DIMENSIONS OF AGRICULTURAL EXTENSION**Credits: 2:0:1****Course Objective:**

- To orient the students with the concept of extension education and its importance in agriculture development
- To expose the students with various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis
- To make the students learn about the new innovations being brought into the Agricultural Extension in India

Course Outcome:

- Students learned the concepts of agricultural extension and rural development programs
- New innovations in the area of agricultural extension in India understood
- Gained practical knowledge on watershed development and self-help groups

Description:

Education: meaning, definition, types. Formal, Informal and Non-formal education and their characteristics. Extension Education and Agricultural Extension: meaning, definition, concepts, objectives and principles. Rural development: meaning, definition, concepts, objectives, importance and problems in rural development. Developmental programmes of pre-independence era - Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme. Development programmes of post-independence era, Firka Development, Etawah- Pilot project and Nilokheri Experiment. Community Development Programme: meaning, definition, concepts, philosophy, principles, objectives, differences between community development and extension education. National Extension service. Panchayat Raj system: meaning of Democratic Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system: power, functions and organizational setup. Agricultural Development Programmes with reference to year of start, objectives and salient features - Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC, Social Justice and Poverty alleviation programmes, Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanti Gram Swaraj Yojana (SGSY), Prime Minister Employment Yojana (PMEY). New trends in extension, privatization. Women Development programmes Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samridhi Yojana (MSY). Reorganized extension system (T & V System)- Salient features, Fort night Meetings, Monthly workshops, Linkages: merits and demerits. Emergence of Broad Based Extension (BBE).

Practicals:

Visits to a village and kisan mandal to study the ongoing development programmes. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayats (GP) and Zilla Praja Parishad (ZPP). Visit and study the District Rural Development Agency (DRDA). Participation in monthly workshops of Training and Visit (T&V) System. Visit to Watershed Development Project area. Visit to a village to study the Self Help Groups (SHGs) of DWCRA. Visit to a voluntary organization to study the developmental activities. Organizing PRA techniques in a village to identify the agricultural problems. Visit to villages.

Reference:

1. Singh, Vir et. al., 2015, Extension for Agriculture and Rural Development, Biotech Press
2. Singh, Ashok K, 2014, Extension Strategies for Agriculture and Rural Development, Daya Publishing House, Delhi
3. Dileep Kumar, Khajan Singh, 2012, Agricultural Extension: Innovations and Dimensions, Satish Serial Publishing House
4. Patel, M.M., Badodya, S. K., Gujpta, Shobhana, 2014, Participatory Approaches for Transfer of Agricultural Technology, Biotech Books, New Delhi
5. Singh A.K. et. al., 2015, Dynamics of Agricultural Extension Approaches, Biotech Books, New Delhi
6. O.P.Dahama & O.P. Bhatanagar, 2014, Education and Communication for Development, Oxford & Ibh Publishing Co Pvt Ltd

17AG1010 PRINCIPLES OF HORTICULTURAL SCIENCES**Credits 3:0:1****Course Objectives:**

- To teach fundamentals of horticulture and horticultural practices
- To impart knowledge on different types of plant propagation and also structures used in farms
- To expose the students to different horticulture vegetables, fruits, species, aromatic and medicinal crops

Course Outcome:

- Fundamentals of horticulture and classification of crops learned
- Different types of plant propagation techniques and structures used in the farm studied
- Gained practical knowledge in plant propagation and pest and disease control

Description:

Horticulture, vegetables, fruits, spices, aromatic and medicinal plants and floriculture, plantation crops, tuber crops, bamboo and mushroom - definition, evolution, art, science, vocation, hobby, etc. Importance, divisions, classification of crops; Commercial orchards, garden and plantations. Selection of site for crops - climate, soil, socio-economic factors; Orchard planning, layout, peg marking, planting systems, spacing, digging pits, age of planting materials, after care, inter cropping, mixed cropping, etc. Tree forms and functions training and pruning in horticultural crops, principles and methods. Techniques of training and pruning – root pruning, girdling, ringing, notching, smudging, and bending, thinning - chemical and mechanical. Phases of growth and development: vegetative / reproductive balance; flowering, bearing habit and its classification; Fruit set - carbon nitrogen relation, structure and process in relation to set and drop, factors affecting and measures to overcome drop; Problems of unfruitfulness - internal factors, external factors – measures to overcome; Seedlessness in horticultural crops - significance and induction; Plant growth regulators in horticulture - natural and synthetic regulators - preparation and methods of application; Plant propagation - definition and basic concepts, types - advantages and disadvantages; Potting and repotting - objectives and uses, containers and potting media/ mixture - kinds, qualities, pre-planting treatments; Propagation by seed - seed qualities, seed testing, seed germination - types of seed dormancy, pre-sowing treatments – factors affecting germination. Asexual propagation - apomixis, polyembryony, plant modifications for vegetative propagation - bud sports, chimeras. Propagation by cuttings - types of cuttings - factors affecting rooting of cuttings. Propagation by layering - advantages and disadvantages -types of layering. Propagation by grafting - advantages and disadvantages, stock - scion relationships, incompatibility; Grafting and budding - methods - advantages and disadvantages - separation and after care; Plant propagating structures - green house/ glass house, hot bed, cold frame, lath house, net house, mist chamber; Nursery - site selection, lay-out, components, progeny orchards, sales unit, display area, management, maintenance, commercial propagation of selected horticultural plants; Micro propagation of horticultural plants - definition, principles, methods, advantages and disadvantages, field of application in horticultural crops.

Practicals

Practice in propagation of plants through seeds. Familiarization with media , implements and containers for plant propagation. Studies on seed testing, certification and storage. Practice in rootstock production, vegetative propagation methods – cutting, budding, grafting layering etc. separation of propagules. Use of growth regulators for plant propagation. Study of propagation through tissue culture. Studies on preparation of designs and estimates for establishment of plant propagation unit, plant growing structures and tissue culture unit. Identification of common pests and diseases in nursery plants and their control. Visit to different types of nurseries, selection of site and

layout– Familiarization with components of nurseries– handling, display and sales of plants – cultural practices – Estimation of production costs for different kinds of planting materials. Practice of potting /bagging, re-potting etc. Packing and transport of nursery materials. Practice in tissue culture laboratory. Registers to be maintained in a commercial nursery. Visit to different nurseries (both government and private).

References:

1. Misra Kaushal Kumar, 2016, Practical Manual of Horticulture, Biotech Press
2. Sharangi, Amit Baran, 2014, Seed Production of Selected Horticultural Crops, Regency Publications
3. Chavan, U. D. et. al., 2015, Key Notes on Horticulture and Agriculture Extension, Daya Publishing House, Delhi
4. Kaleeshwari R. K., Latha M. R., Rajeswari R., 2013, Compendium of Objective Soil Science, Satish Serial Publishing House
5. Bose, T K., Mitra, S K. and Sadhu, K. 1986. Propagation of tropical and subtropical horticultural crops. Naya Prokash, Calcutta
6. Christopher, E P. 1958. Introductory Horticulture. Mc Graw Hill, New Delhi
7. Denixon, R I. 1979. Principles of Horticulture. Mac Millan, New York
8. Edmond, J B., Sen, TD, Andrews, T S and Halfacre, R G. 1977. Fundamentals of Horticulture. Tata Mc Graw Hill, New Delhi
9. Halfacre, R G. and Barden, J A. 1979. Horticulture. Mc Graw Hill, New Delhi
10. Hartmann, H T. and Kester, D E.1986. Plant propagation - Principles and Practices. Prentice-Hall, New Delhi
11. Janick, J. 1963. Horticultural Science. W.H. Freeman, Sanfrancisco
12. Kumar, N. 1990. Introduction to Horticulture, Rajalekshmi Publication, Nagercoil
13. Leopold, A.C. and Kriedeman, P.E. 1975. Plant Growth and Development. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.
14. Thorpe, T.A. 1981. Plant Tissue Culture: Methods and Application in Agriculture. Academic Press, New York
15. Sheela, V.L. 2011. Horticulture. MJP Publishers, Chennai
16. Peter, K. V.2014, Basics of Horticulture. New India Publishing Agency, New Delhi.
17. Singh, J. 2002. Basic Horticulture, Kalyani Publishers, Ludhiana

17AG1011 INTRODUCTION TO SOIL SCIENCE

Credits: 3:0:1

Course Objectives:

- To highlight the physical properties of soils
- To understand soil-water interaction and thermal properties of soil
- To study the chemical and biological aspects of soil

Course Outcome:

- Students made familiar with the role of soils in agriculture
- Familiarized with physical, chemical, biological aspects of soil and soil-water-plant interaction
- Learned soil biology including the beneficial and harmful role of soil organism

Description:

Soil-Pedological and edaphological concepts -origin of the earth - earth's crust - composition. Rocks and minerals. Weathering - soil formation - factors and processes - components of soils -soil profile. Soil physical properties - soil texture - textural classes - particle size analysis. Soil structure classification - soil aggregates – significance. Soil consistency - soil crusting. Bulk density and particle density of soils and porosity – their significance and manipulation. Soil compaction - soil colour. Elementary knowledge of soil classification. Soils of India - geological formations – characterization of soils of Tamil Nadu. Soil water - retention and potentials - soil moisture constants - movement of soil water – infiltration – percolation – permeability – drainage - methods of determination of soil moisture. Thermal properties of soils - soil temperature - soil air - gaseous exchange - influence of soil temperature and air on plant growth. Soil colloids – properties – nature - types and significance. Layer silicate clays - their genesis and sources of charges. Adsorption of ions - ion exchange - CEC and AEC - factors influencing ion exchange and its significance. Concept of pH - soil acidity – brief overview of saline, sodic and calcareous soils.

Soil organic matter – composition – decomposability – humus - fractionation of organic matter. Carbon cycle - C: N ratio. Soil biology – biomass - soil organisms and their beneficial and harmful roles.

Practical

Determination of bulk density and particle density - aggregate analysis - soil strength. Soil moisture determination - soil moisture constants – field capacity - infiltration rate - water holding capacity. Soil texture and mechanical analysis. Soil temperature. Analytical chemistry – basic concepts - techniques and calculations. Collection and processing of soil for analysis – organic carbon, pH, EC, - Study of a soil profile – Identification of rocks and minerals. Total elemental analysis of soils. Estimation of CEC.

References

1. Millar, Charles Ernest, Turk L M, 2013, Fundamentals of Soil Science, Biotech Press
2. Biswas, T.D. and Mukherjee, S.K. 1987. Text Book of Soil Science. Tata McGraw Hill Publishing Co., New Delhi
3. Brady, N.C. 1990. Nature and Properties of Soils. 10th Edn, Macmillian Publishing Co. Inc., New York
4. Das.D.K, 1997. Introductory Soil Science. Kalyani Publishers, New Delhi.
5. Foth, H.D. and Turk, L. M. 1972. Fundamental of Soil Science. 5th Edn. Wiley Eastern Pvt. Ltd., New Delhi
6. Gupta, P.K. 2007. Soil, Plant, Water and Fertilizer Analysis. Published by AGROBIOS (India), Jodpur
7. ISSS, 2002. Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI, New Delhi
8. Jaiswal, P.C. 2006. Soil, Plant and Water Analysis. 2nd Edn. Kalyani Publishers, Ludhiana
9. Samuel L.Tisdale, Werner.L. Nelson, James D.Beaton and John L. Havlin. 1995. Soil Fertility and Fertilisers. 5th Edn. McMillan Publishing Company, USA.

17AT1001 INTRODUCTION TO AGRICULTURE

Credit: 2:0:0

Course Objectives:

- To introduce the scope of agriculture to engineering students
- To impart knowledge on soil-water-plant relationship
- To familiarize with plant growth and fertilizer application and irrigation

Course Outcome:

- Basics of agriculture science learned
- Soil-water-plant relationship learned
- Different stages of plant growth and application of fertilizers studied

Description:

Orientation to agriculture and agricultural engineering. Soils: Nature and origin of soil; soil forming rocks and minerals, soil forming processes, important soil physical properties and their importance. Ion exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility. Soil reaction – acid, saline and sodic soils. Agronomy: Definition and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tith and its characteristics. Soil water plant relationship and water requirement of crops. Soil fertility and its management, integrated nutrient management. Bio-fertilizers and vermin composting. Weeds and their control, integrated weed management. Crop rotation, cropping systems, relay cropping and mixed cropping. Sustainable agriculture, integrated farming system, precision farming, organic farming and good agricultural practices. Horticulture: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post-harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.

References:

1. Sharma, Rakesh Kumar et. al., 2014, Basics of Agriculture for Engineers, Daya Publishing House, Delhi
2. Gajendra Singh Tomar, 2010, Agronomy: Basic and Applied, Satish Serial Publishing House
3. Bose, T.K and S.K. Mitra. 1990. Fruits, Tropical and Subtropical. Naya Prakash, Calcutta.

4. Brady, Nyle C. 1988. The Nature and Properties of Soils. Eurasia Publishing House Pvt Ltd, New Delhi.
5. Das, P.C. 1993. Vegetable Crops of India. Kalayani Publishers, New Delhi.
6. De, G.C. 1989. Fundamentals of Agronomy, Oxford & IBH Publishing Co Pvt Ltd, New Delhi.

17HO1001 BOTANY OF HORTICULTURAL CROPS

Credits: 3:0:0

Course Objectives:

- To teach the fundamentals of botany of the horticultural crops
- To expose the student to systematic botany
- To learn the basics of morphology and taxonomy of crops

Course Outcome:

- The students learned the basics of botany
- The students familiarized with botanical terms in relation to horticultural crops
- This fundamental course helped students to understand the breeding of horticultural crops

Description:

Systematic botany– terminology, morphological description and classification – root, stem, leaf, inflorescence, flower and fruit – flowering mechanism – modes of pollination asexual/vegetative reproduction – floral biology – fertilization and fruit set. Principles involved in nomenclature, ICBN rules and recommendations with special reference to names of hybrids and names of cultivated plants. Floral biology, pollination, fruit set and economic part in the families; Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin), Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove), Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose). Floral biology, pollination, fruit set and economic part in the families; Solanaceae (tomato, brinjal, chilli, potato), Malvaceae, Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber), Moringaceae, Fabaceae (peas, French beans), Alliaceae (onion, garlic), Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae, Amaranthaceae, Convolvulaceae (sweetpotato), Araceae (elephant foot yam, colocasia), Dioscoreaceae (yam, medicinal dioscorea). Floral biology, pollination, fruit set and economic part in the families; Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (Vanilla, Dendrobium orchid), Apiaceae (Umbelliferae) (coriander), Myristicaceae, Lauraceae, Leguminosae, Caesalpiniaceae, Camelliaceae, Rubiaceae, Arecaceae(Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaceae(Cocoa). Floral biology, pollination, fruit set and economic part in the families; Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae, Acanthaceae, Caryophyllaceae, Iridaceae, Apocynaceae, Poaceae (Graminae), (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Lamiaceae (Labiatae) (coleus, patchouli, mint, maruvu), Scrophulariaceae.

Practical:

Observations and recordings of the morphology of root, stem, leaf, flower and fruit. Study of taxonomy and morphology of crops in the above families – herbarium (minimum 50 – covering not less than 25 families) - collection of the crops mentioned in theory.

References:

1. Mauseth, J.D. 2009. Botany: An Introduction to Plant Biology. Jones and Bartlett Publishers, MA.
2. Spichiger, R., Savolainen, V., Figeat, M., Jeanmond, D. 2004. Systematic Botany of Flowering Plants. Science Publishers Inc., USA.
3. Jansi Rani, P. Subramanian, S., Veeraragavathatham and S. Thamburaj, 1997. Botany of Vegetable Crops. KRS Screen Printers, Lawley Road, Coimbatore.
4. Gangulee, Das and Datta. 1997. College Botany Vol. I. New Central Book Agency (P) Ltd., Calcutta
5. Genin, A. 1994. Application of Botany in Horticulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Kochhar, S.L. 1992. Economic Botany in the Tropics. Macmillan India Ltd., Madras
7. Madhu Arora, 1991, Dictionary of Botany. Anmol Publications Pvt. Ltd., New Delhi.
8. Joseph Y. Bergen, 1990. Fundamentals of Botany. Arihant Publishers, Jaipur
9. Subhash Chandra Datt, 1989. Systematic Botany – Willey Eastern Ltd., New Delhi.
10. Bahadur and Achari. 1989. A Manual of Botany. Anmol Publications, New Delhi.

11. Sambamurthy and Subrahmanyam. 1989. Text Book of Economic Botany. Wiley Eastern Ltd., New Delhi.
12. Simpson, B.B. and Ogorzaly, M.C. 1986. Economic Botany. McGraw Hill Book Company, New York.

17HO1002 PROPAGATION OF HORTICULTURAL CROPS

Credits: 2:0:1

Course Objectives:

- To impart skill oriented knowledge on media preparation
- To teach students on propagation methods
- To familiarize with the maintenance and after care of propagated plants

Course Outcome:

- Students benefited with hands-on training in media preparation
- Students learned about mother plant selection and propagation techniques
- Students familiarized with the maintenance and after care of propagated plants

Description:

Basics of plant propagation: Scope and importance - different methods - definitions – sexual propagation - importance, advantages and disadvantages - asexual propagation - importance, advantages and disadvantages - agencies involved in the nursery development - government schemes for development of nurseries - establishment of nursery - site selection - tools and implements - mist chamber - phytotron – humidifiers - greenhouse - glasshouse - polyhouse - shade net - cold frames - hot beds - pit nursery - ball and bur lapped culture - media and containers - soil sterilization - manures and manuring - liquid manures. Sexual propagation: Micro and megasporogenesis - apomixis - mono and polyembryony - seeds - quality - nursery bed - protray culture - sowing - seed viability - longevity - germination - dormancy - types of dormancy - seed treatments - seed invigoration - seedling vigour. Asexual propagation: cutting and layering. Genetic variations - chimeras and types - methods of vegetative propagation identification of plus trees – mother block – raising clonal nursery - types of cuttings – factors influencing rooting of cuttings - use of growth regulators - layering – advantages and disadvantages - methods of layering - anatomical and physiological basis of rooting. Asexual propagation: grafting, budding and propagation through special organs. Grafting and budding; Methods - advantages and disadvantages - rootstocks - scion bank - factors for successful graft union - selection, pre-curing and collection of scion - bud wood selection - bud wood certification - anatomical and physiological basis of graft / bud union - stock-scion relationship - root stock influences - after care and hardening – techniques of propagation through specialized organs - tubers - bulbs - corms - runners - suckers - crown - slips - rhizome - offshoots - top working – quality management and nursery certification –display, packing, transport and marketing. Techniques of micro propagation: Micro propagation – definitions - different methods - protocol of micro propagation - Stage I establishment and sterilization - Stage II shoot multiplication - Stage III root formation - Stage IV acclimatization and hardening – specific protocol for aseptic culture - explants - sterilization techniques - types of media - composition - media preparations - meristem tip culture - micro grafting - in vitro clonal propagation of important horticultural crops - constraints and problems in micro propagation – after care - packing, transport and marketing - infrastructure requirements - establishment of commercial tissue culture units - visit to commercial TC units- status of micro propagation in India.

Practical:

Propagation structures - tools and implements - propagation media - containers - preparation of nursery beds - seed treatment - sowing - plug transplants / seedling production - potting, depotting and repotting of plants - methods of asexual propagation through cuttings, layering, grafting and budding - scion bank – techniques of cuttings - leaf and leaf bud cuttings - stem cuttings - single nodal cuttings and root cuttings - techniques of layering - potting of layers and hardening - grafting methods - separation of grafts - potting and maintenance of grafted plants - budding and maintenance of budded plants - mist chamber - structures - maintenance - use of mist chamber for seed and vegetative propagation - hardening and maintenance – shade structure - nutrition and plant protection - application of growth regulators - standardization of formulations - growth regulators for seed and vegetative propagation - project preparation for commercial nurseries – visit to commercial nurseries and tissue culture units.

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17HO1003 PRODUCTION TECHNOLOGY OF TROPICAL AND ARID ZONE FRUIT CROPS

Credits: 2:0:1

Course Objectives:

- To impart knowledge on the scenario of fruit cultivation in tropical and arid zones
- To impart knowledge on advanced production techniques
- To apprise on production constraints

Course Outcome:

- Practical knowledge on specialized production techniques of tropical and arid zone fruits
- Understanding the production constraints
- Skill management for solving field problems

Description:

Principles and cultivation of tropical fruits: Mango and banana-Scope and importance of tropical fruits cultivation – overview: global, national and regional levels – area, production and export potential– horticultural zones of India and Tamil Nadu with emphasis on tropical fruits- GAP- organic production - composition and uses – origin and distribution – species and cultivars - climate and soil requirements - species and varieties - cropping systems- propagation techniques - planting systems and planting density - after care – training and pruning – water management, macro and micronutrient management, weed management – special horticultural techniques - use of plant growth regulators - production constraints - physiological disorders – post harvest handling - economics of production. Tropical fruits- Papaya, sapota and guava: Composition and uses – origin and distribution – species and cultivars – climate and soil requirements, cropping systems- varieties - propagation techniques – planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management – GAP - organic production - special horticultural techniques – sex forms and pollination - use of plant growth regulators - production constraints - physiological disorders - pre and post-harvest handling - economics of production. Tropical fruits: acid lime, sweet orange and jack fruit: Composition and uses – origin and distribution – species and cultivars – climate and soil requirements, cropping systems- varieties - production constraints - propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management - GAP - organic production - special horticultural techniques - use of plant growth regulators - physiological disorders - pre and post-harvest handling – economics of production. Arid zone fruits: Aonla, ber, pomegranate and date palm: Dryland horticulture – importance and scope in India and Tamil Nadu- distribution of arid and semi-arid zones in India and Tamil Nadu; Composition and uses – origin and distribution – species and cultivars - climate and soil requirements – varieties - cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns for rainfed

horticultural crops- in situ grafting and budding techniques – alternative land use systems – mulching - soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – regulation of cropping – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production. Arid zone fruits - custard apple, jamun, bael, wood apple and manila tamarind: Composition and uses – origin and distribution – species and cultivars – climate and soil requirements – varieties - cropping systems and intercropping – crops suitable for dry land system – spacing and planting patterns for rain fed horticultural crops- in situ grafting and budding techniques – alternative land use systems – mulching – soil and moisture conservation methods – chemical application – anti-transpirants – management of nutrients, water, weeds and problem soils – training and pruning methods – physiology of flowering – crop regulation – top working and rejuvenation – use of plant growth regulators – post harvest handling – economics of production.

Practical:

Description and identification of cultivars/varieties - nursery management - nursery preparation, seed sowing and raising seedlings / rootstocks, practicing propagation techniques of mango, banana, papaya, sapota, guava, acid lime, sweet orange, aonla, ber, pomegranate, date palm, custard apple, jamun, bael, wood apple and manila tamarind. Banana scoring techniques. Selection and pre-treatment of banana suckers - desuckering in banana –planting systems- manures, fertilizers and biofertilizers application in mango, banana, papaya, sapota, guava, acid lime, sweet orange and aonla – application of growth regulators - sex forms in papaya – sibmating and seed production in papaya – latex extraction and preparation of crude papain – training and pruning in mango, sapota, guava, acid lime and sweet orange, aonla, ber, pomegranate and date palm - practising harvesting methods - ripening of fruits - grading and packaging - visit to commercial orchards - project preparation on production economics for fruits.

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17HO1004 PRODUCTION TECHNOLOGY OF TROPICAL VEGETABLE CROPS

Credits: 2:0:1

Course Objectives:

- To teach the students on the scenario of vegetable cultivation
- To impart knowledge on advanced production techniques
- To apprise on production constraints

Course Outcome:

- Hands-on experience of vegetable cultivation
- Knowledge on quality requirement and production techniques
- Skill management for solving field problems

Description:

Overview of vegetable cultivation: Area, production, world scenario, industrial importance, export potential of tropical vegetable crops – institutions involved in vegetable crops research. Classification of vegetable crops - Effect of climate, soil, water and nutrients on vegetable crop production and their management– cropping systems. Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden – types of vegetable farming and contract farming- rice fallow cultivation, river bed cultivation, rain fed cultivation, organic farming – GAP in vegetable production – export standards of vegetables. Solanaceous vegetables and bhendi: Composition and uses – area and production- climate and soil requirements – season-varieties and hybrids – seed rate- nursery practices-containerized transplant production and transplanting –preparation of field-spacing-

planting systems-planting- water and weed management-nutrient requirement-fertigation-nutrient deficiencies-physiological disorders- use of chemicals and growth regulators-cropping systems-constraints in production-harvest-yield crops. Tomato, brinjal, chilli and bhendi. Bulbous and Cucurbitaceous vegetable crops: Composition and uses- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting– water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders – sex expression - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield. Onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, coccinia, cucumber and gherkin. Fabaceous vegetable crops and greens: Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids - seed rate – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders- use of chemicals and growth regulators - cropping systems – constraints in production harvest – yield. Cluster beans, cowpea, lab-lab, moringa, chekurmanis, palak, basella and amaranth. Tuber crops: Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids - seed rate –preparation of field - nursery practices and transplanting – spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders- use of chemicals and growth regulators - cropping systems – - constraints in production –virus elimination in cassava- harvest – yield. Cassava, sweet potato, colocasia, vegetable coleus, amorphophallus, edible dioscorea, and yam bean.

Practical:

Identification and description of tropical vegetable crops –nursery practices and transplanting for transplanted vegetable crops- preparation of field and sowing /planting for direct sown/ transplanted vegetable crops, kitchen garden- herbicide use in vegetable culture - top dressing of fertilizers and inter-culture – use of growth regulators – identification of nutrient deficiencies - physiological disorders- harvest indices and maturity standards - post harvest handling and storage – marketing – seed extraction- working out cost of cultivation for tropical vegetable crops – project preparation for commercial cultivation. Visit to commercial vegetable growing areas, market and processing centre.

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