AEG-221 Farm Machinery and Power (1+1)

Objectives

To enable the students to understand the need of farm power, basic principles and parts of IC engine, different tillage, sowing, intercultural, plant protection equipment, working principles of threshers, harvesting of field and horticultural crops.

Theory

Status of Farm Power in India; Sources of Farm Power, I.C. engines, working principles of IC 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; Criteria for selection of tractor and machine implements. 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

Study of different components of I.C. engine. To study air cleaning and cooling system of engine; Familiarization with clutch, transmission, differential and final drive of a tractor; Familiarization with lubrication and fuel supply system of engine; Familiarization with brake, steering, hydraulic control system of engine; Learning of tractor driving; Familiarization with operation of power tiller; Implements for hill agriculture; Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow; Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and trans planter; Familiarization with different types of sprayers and dusters; Familiarization with different inter-cultivation equipment; Familiarization with harvesting and threshing machinery; Calculation of power requirement for different implements.

Suggested readings

1. `Jagdiswar Sahay – Elements of Agricultural Engineering
2. `Jain, S.C. and C.R. Rai-Farm Tractor and maintenance and repair. Standard Publishers, 1705B,Naisarak. Delhi- 110006
3. `Ojha, T.P. and A.M. Michael, A.M. Principles of Agricultural Engineering. Vol.I. Jain brothers,16/893, East Park Road, Karol Bagh, New Delhi -110005
4. `Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi

AEG-321 Renewable energy in Agriculture and Allied Sector (1+1)

Objectives

1. To gain the knowledge on different types of materials used in Renewable Energy
2. To understand the importance of Renewable Energy technology and its applications
3. To train the students on the applications of solar thermal technology

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. Availability of bio mass and their application in different places. Indian Knowledge System Based energy sources and their contribution in agriculture sector, and traditional technology for utilization of agricultural biomass as energy sources. Controlled energy extraction from agricultural biomass using traditional Indian knowledge systems.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, gasifier, production process of biodiesel, briquetting machine, production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing, solar cooker and solar drying system. To study solar distillation, solar pond and solar wind hybrid system. Field visit to Solar –Wind farm.

Suggested readings

1. C.S. Solanki. 2011. Solar Photovoltaic – Fundamentals, Technologies and Applications. PHI Learning Pvt. Ltd.
2. S. Sukhatme and J. Nayak. 2008. Solar Energy: Principles of Thermal Collection and Storage. Third Edition (Tata McGraw-Hill).
3. V.V.N. Kishore. 2008. Renewable Energy Engineering and Technology: Principles and Practice, Teri, India

EC-4111 Soil and Water Conservation Engineering (3+1)

Objectives

To acquaint and equip the students with soil and water conservation techniques, soil erosion problems and control measures, design of irrigation channels, land surveying and levelling.

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. Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields; compass surveying-calculation of bearings and area; plane table surveying-calculation of area by radiation method; levelling-levelling equipment, terminology, methods of calculation of reduced levels. 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

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Acquaintance with chain survey equipment; plotting of chain triangulation; plotting of cross staff survey; plotting compass surveying; plotting plane table survey; levelling-calculation of reduced levels, profile levelling. Problem on wind erosion.

Learning Outcome

This course enables the students to have understanding about the soil degradation and their effects, estimation of soil loss, soil erosion control measures, soil and water conservation technologies, water conveyance systems, land surveying and levelling.

Suggested Readings

1. Mal, B. C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.

2. Michael, A. M. and Ojha, T. P. 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.

4. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

5. Basak, N.N. Surveying and levelling, Tata Mcgraw Hill Education Private Limited, New Delhi publication.

EC-4112 Geoinformatics and Remote Sensing, Precision Farming (3+1)

Objectives

1. Enabling students acquire knowledge on basics of remote sensing technique for precision farming applications
2. To provide a comprehensive knowledge of remote sensing, precision farming and its benefits in improving crop production and soil health management

Theory

Introduction and history of remote sensing; sources, Principles of remote sensing, propagation of radiations in atmosphere; Interaction with matter; Application of remote sensing techniques land use soil surveys; crop stress and yield forecasting; Advantages and disadvantages of remote sensing; Remote sensing institutes in India; Basic Concepts about geoinformatics. Data sharing; Expert System: Introduction to expert system, Characteristics and features of expert system, Applications of Expert System, Importance of Expert system, Rule based system architecture; Software Agents; Impact of Block chain and it's concepts; Probability and Statistics: Bayes Theorem, correlation and Covariance, Continuous Random variables and probability distribution function, various forms of distributions, central limit theorem; Basics of Machine Learning: Random forest, SVM, ensemble methods; Basics of Deep learning: various model architectures and it's training aspects; Hyperspectral and Thermal Remote Sensing; Proximal Soil and Crop Sensors.

Practical

Familiarization with different remote sensing equipment and data products, Interpretation of aerial photographs and satellite data for mapping of land resources, Global positioning system (GPS), Basics of Geographic Information System (GIS), Georeferencing of toposheets, Digital soil mapping with different variables, Basics of multivariate data analytics, Principal component analysis and regression applications, clustering methods and geostatistics are essential in agricultural studies.

Suggested readings

1. Data Analytics in Bioinformatics: A Machine Learning Perspective. Editor (s): Rabinarayan Satpathy, Tanupriya Choudhury, Suneeta Satpathy and Sachi Nandan.
2. Machine Learning Approaches to Bioinformatics by Zheng Rong Yang.
3. Text Book of Remote Sensing and Geographical Information Systems by M. Anji Reddy.
4. Precision Agriculture Technologies for Food Security and Sustainability By A El-Kader, M Sherine, M El-Basioni and M Basma.
5. Principles and Theory of Geoinformatics by P.K. Garg. Khanna Publishers. 296p
6. Advances in Geoinformatics Remote Sensing and GIS by Bhunia, Gouri Sankar, Uday Chatterjee and Gopal Krishna Panda. BIO GREEN
7. Artificial Intelligence: Machine Learning, Deep Learning, and Automation Processes by John Adamssen. Efalon Acies.
8. Remote Sensing and Image Interpretation, 6th edn (WSE) Paperback – 1 January 2011, Willey Student Edition.

9. Remote Sensing and Geographic Information by A.M. Chandra and S.K. Ghosh. Narosa.

EC-4113 Food Science and Nutrition (3+1)

Objectives

To impart knowledge on the biochemical aspects of various nutrients and their interactions in foods during processing, storage and deterioration

Theory

Introduction on fundamentals of foods and human nutrition; Basic food groups; Concept of balanced diets; Recommended Daily Allowances (RDA) for various age groups; Biochemical composition, energy and food value of various food grains, fruits and vegetables; Carbohydrates, proteins, fats as nutrients and their interactions; Physio-chemical, functional and nutritional characteristics of essential nutrients- sources and functions, Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system; Protein quality evaluation. Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinational factors and biochemistry of post-harvest storage, losses during processing. Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage; Food fads, food safety and quality standards. Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.

Practical

Proximate analysis of foods; calorific value of foods; Estimation of vitamins, phenols and flavonoids, carotenoids, antinutrients like Phytate/ Oxallate, Trypsin and Chymotrypsin inhibitor activities, limiting amino acids in food stuff.

Suggested readings

1. Damodaran, S. and Parkin, K.L. (Ed.). 2017. Fennema's Food Chemistry. CRC Press
2. Gibney, M.J., Lanham-New, S.A., Cassidy, A. and Voster, H.H. (Ed.). 2009. Introduction to Human Nutrition. Wiley-Blackwell.
3. Trueman, P. 2007. Nutritional Biochemistry. MJP Publishers.
4. Rekhi, Tejmeet and Yadav, Heena. 2014. Fundamentals of Food and Nutrition. Elite Publishing House. 257p.
5. Dharmesh Kumar. Food Science and Nutrition. Random.

EC-4128 Protected Cultivation (3+1)

Objective

To educate students on the scientific and commercial cultivation of important value-added products in protected cultivation

Theory

Protected cultivation- importance and scope, status of protected cultivation in India and World, types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers, Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc. Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables. Insect pest and disease management.

Practical

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

Suggested readings

1. Greenhouse operation and management by Paul V. Nelson.
2. Protected cultivation of Horticultural crops by Madan Kr. Jha, Sujan Singh Paikra and Manju Rani Sahu.
3. Protected Cultivation of Horticulture Crops by Itigi Prabhakar. IBPSS.
4. Advances in Protected Cultivation by Brahma Singh and Balraj Singh. NIPA,252p.
5. Protected Cultivation and Smart Agriculture by Eds. Sagar Maitra, Dinkar J. Gaikwad and Tanmoy Shankar. New Delhi Publishers, 263p.
6. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops by B. Ashok Kumar, Eggadi Ramesh and Sindhu V. Jain Brothers.

SEC-1104 Repair and maintenance of Farm Machinery (0+2)

Practical

Operation of various agricultural equipment, Repair and maintenance of implements – adjustment of functional parameters in tillage implements. Replacement of broken components in tillage implements. Replacement of furrow openers and change of blades of rotavators. Adjustments in a thresher for different crops. Replacement of V-belts on implements. Sprayers operation and maintenance, Care and maintenance procedure of agricultural machinery during operation and offseason. Driving practice of tractor. Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Hitching & De-hitching of mounted and trail type implement to the tractor. Introduction to tractor maintenance – precautionary and break-down maintenance. Introduction to trouble shooting in tractors. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation. Safety hints. Top end overhauling. Fuel saving tips. Preparing the tractor for storage.

SEC-1206 Surveying and Levelling (0+2)

Practical

Surveying: Acquaintance with surveying tools & equipment, scales, geometrical construction. Chain Surveying: Introduction about chain surveying instruments, measurement of distance by a chain and chaining, ranging, chaining on sloping ground, offset and offsetting, obstacles in chain surveying, introduction used for setting out right angles, introduction about triangulation survey, calculation of area of regular and irregular fields. Compass surveying: Identification and parts of instruments in compass survey, determining the bearing of a given triangular plot and calculation of included angles, determining the bearing of a plot and calculating included angles magnetic declination and plotting of compass survey. Plane table surveying: Setting up of plane table and methods of plane tabling, methods of plane table survey, traversing method of plane table survey, locate and plot new building by two point and three-point problem. Levelling & Contouring: General principle, types of levels and their temporary and permanent adjustments. Methods of levelling, reduction of levels, precise levelling and trigonometric levelling; Introduction of contouring, topography and contour, tracing of grade contour, computation of volume.

SEC-2103 Agriculture Waste Management (0+2)

Practical

Collection and preparation agricultural waste sample. Determination of pH, EC, CECe, heavy metals, BOD, COD, TSS, TDS, NH 4, Total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment operation, Biogas Technology, Waste water treatment: primary, secondary and tertiary treatment,

Maintenance and safety hazards, computer software and models. Survey of different agri waste from livestock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals, Preparation of compost, Vermicomposting, briquetting and analysis of compost.

SEC-2104 Post-Harvest Engineering (0+2)

Practical

Moisture content in food and its determination by oven drying & other methods. Determination of engineering properties of biomaterials (shape and size, specific gravity, bulk density and porosity, angle of repose). Operations of milling of grains, such as rice, pulses, oilseeds (cleaning, grading, dehusking, polishing). Study of different types of dryers and Different methods of drying: (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer), Study of drying characteristics. Storage systems for grains, Storage of perishable products (cold storage, CA, MA etc.). Value addition concept; Principles and methods of preservation.

Indian Knowledge System of post-harvest handling, storage and preservation -Sun drying of grains and other crops. Indigenous mathods and devices for grain milling (manual winnowing, dheki, chakki, traditional parboling and puffing method, ghani etc.). Indigenous structures and methods of storage of grains and vegetables. Traditional cooling methods like mud pots and underground storage. Traditional methods of pest control during storage of grains and seeds. Traditional practices to enhance shelf life of perishables

SEC-2202 Food Processing (0+2)

Practical

Unit operations. Process design and preparation of process flow chart; Technologies for value addition of cereals, pulses and oil seeds- milled, puffed, flaked, roasted and malted products, bakery products, snack food, extruded products. Operation and maintenance of roller flour mill, rice mill, spice grinding mill, milk plant, dal and oil mill, fruit/vegetable processing plant, sugar mill and other food processing industries