

B. Sc. (Hons) Agriculture

Agricultural Engineering

- **Syllabus**
- **Teaching Schedule**
- **Suggested Readings**

Agril. Engineering

Sr. No.	Semester	Course No.	Credits	Course Title
1	II	ENGG 121	2(1+1)	Soil and Water Conservation Engineering
2	III	ENGG 232	2(1+1)	Farm Machinery and Power
3	IV	ENGG 243	2(1+1)	Renewable Energy and Green Technology
4	VI	ENGG 364	2(1+1)	Protected Cultivation and secondary Agriculture
5	VIII	ELM ENGG 485	10(0+10)	Natural Resources Management
		Total	18 (4+14)	

Course :	ENGG 121		Credit:	2(1+1)	Semester-II
Course title:	Soil and Water Conservation Engineering				

Syllabus

Theory

Introduction of soil and water conservation - definition and scope, causes of soil erosion, types, geological and accelerated soil erosion, Accelerated soil erosion - water and wind erosion definitions, Forms of water erosion, Wind erosion : Principle, mechanics, types of soil movement, Land use capability classification and planning, erosion control measures – Agronomical and Engineering measures (examples on grassed waterways) Contouring, strip cropping, contour bunds, graded bunds, terracing, waterways , Gully development classification and control measures : Temporary and permanent structures , Soil loss estimation by USLE (examples), Hydrological cycle, Runoff: Definition, types, factors affecting, estimation. Examples on rational formula, Water harvesting and its techniques, types (examples on capacity), Introduction of surveying: definitions, object of surveying, use of surveying, classification of surveying and principles of surveying, Watershed: definition, characteristics, deterioration, classification, Watershed management: definition and objects, steps of watershed management, Watershed monitoring and evaluation.

Practical

General status of soil conservation in India, Study of surveying instruments, Study of leveling instruments, Chain triangulation survey, Plane table survey, Estimation of runoff by rational method, Estimation of soil loss (USLE), Measurement of soil loss (multi slot divisor), Study of grassed waterway, Study of graded bunds, Study of contour bund and compartmental bunding, Study of terrace, Study of CCT and staggered trenches, Study of gully control structures (KT weir, Drop spillway, earthen nala bund), Determination of pond capacity, Visit to a developed watershed

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1	Introduction of soil and water conservation - definition and scope, causes of soil erosion, types, geological and accelerated soil erosion	7
2	Accelerated soil erosion - water and wind erosion definitions, types of water erosion	7
3	Wind erosion : Principle, mechanics, types of soil movement	6
4 & 5	Land use capability classification and planning, erosion control measures (list and adoptability of agronomical and engineering measures) Contouring, strip cropping, contour bunds, graded bunds, terracing, waterways	8
6	Gully development, classification and control measures : Temporary and permanent gully control structures	7

Lecture	Topic	Weightage (%)
7	Soil loss estimation by USLE (examples)	7
8 & 9	Hydrological cycle, Runoff: Definition, types, factors affecting	9
10	Estimation of runoff. Examples on rational formula with Tc	7
11	Water harvesting and its types (examples on capacity of dug out types FP)	7
12	Introduction of surveying: definitions, object of surveying, use of surveying, classification of surveying and principle of surveying	8
13	Contour : definition, uses and characteristics	6
14	Watershed: definition, characteristics, deterioration, classification	7
15	Watershed management: definition and objects, steps of watershed management	8
16	Watershed monitoring and evaluation	6
	Total	100

b) Practical

Experiment	Topic
1	General status of soil conservation in India
2	Study of surveying instruments
3	Study of leveling instruments
4	Chain triangulation survey
5	Plane table survey
6	Estimation of runoff by rational method
7	Estimation of soil loss (USLE)
8	Measurement of soil loss (multi slot divisor)
9	Study of grassed waterway
10	Study of graded bunds
11	Study of contour bund and compartmental bunding
12	Study of terrace
13	Study of CCT and staggered trenches
14	Study of gully control structures (KT weir, Drop spillway, Earthen Nala bund)
15	Determination of pond capacity
16	Visit to a developed watershed

Suggested Readings

- 1) Principles of Agril. Engg.- Vol – II by A. M. Maichael& T. P. Ojha (2011), Jain Brothers, New Delhi
- 2) Soil and Water Conservation Engineering by R. Suresh (2000), Standard Publishers Distributrs, Delhi
- 3) Surveying & Levelling Part – 1 by T.P.Kanetkar and S.V.Kulkarni (2002), Pune Vidyarthi Griha Prakashan, Pune

- 4) Irrigation Theory and Practice By A. M. Michael (2005), Vikas Publishing House Pvt Ltd, New Delhi
- 5) Soil Conservation in India by Rama Rao M.S.V. (1974) ICAR, New Delhi.
- 6) Manual of Soil & Water Conservation Practices by Gurmel Singh and others (1996), Oxford & IBH publishing Co. Pvt. Ltd., New Delhi
- 7) Watershed Hydrology by R. Suresh (1997), Standard Publishers Distributors, Delhi
- 8) Surveying & Levelling Part – 1 by N. N. Basak (2005) Tata McGraw-Hill Publishing Company Ltd, New Delhi
- 9) Manual of SWCE by Swab G. O. et al (1996) WMC Brown Co. Publishers, Iowa, USA
- 10) Agricultural Engineer's Handbook by Richey et al (1961) Tata McGraw-Hill Publishing Company Ltd, New York

Course :	ENGG 232		Credit:	2(1+1)	Semester-III
Course title:	Farm Machinery and Power				

Syllabus

Theory

Status of Farm Power in India, Sources of Farm Power , Scope of Mechanization, 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

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 operation of power tiller, 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 transplanter Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1	Sources of farm power in ..Human, Animal, Mechanical, electrical, solar, Wind Power, Scope of Mechanization.	6
2-3	Principle of operation of I.C. engine- I.C. engine working principles Two and Four stroke engine, Engine terminology and examples	13
4-5	I.C. Engine systems -Fuel supply system, cooling system, Air cleaner, lubrication of tractor.	12
6-7	Tractor -Tractor types and their selection, fixed and operating cost of tractor power and attached implements with examples	13
8	Tillage - Tillage, objectives of tillage, classification & types of tillage, Tillage implements	7

Lecture	Topic	Weightage (%)
9	Primary tillage implements - M. B. plough and Disc plough, Rotavator, with examples	6
10	Secondary tillage implements - Harrows, cultivators & examples	6
11-12	Implements for inter-culturing operations - Hand tools, Improved hoes, Wheel hoe, Multipurpose hoe, Tractor drawn intercultural equipments	12
13	Seed drills - Sowing methods, seed drill, components of seed drill, seed metering mechanism (Fluted roller and plate type only) , types of furrow openers, calibration of seed drill, examples	7
14	Study of planter -Planter, Functions, seed metering devices, type of planters, solved examples	6
15	Plant protection equipments- Classification, types of spraying and types of dusting machines.	6
16	Harvesting and threshing equipments-Definition of harvesting and threshing, harvesting /threshing methods implements , mower and combine harvester-thresher, solved examples	6
	Total	100

b) Practical

Experiment	Topic
1.	Study of components of internal combustion (I. C.) engine
2.	Study of two stroke cycle engine
3.	Study of four stroke cycle engine
4.	Study of Fuel supply systems for S. I. engines
5.	Study of Fuel supply systems for C. I. engines
6.	Study of Air Cleaning and Cooling systems of an engine
7.	Study of Lubrication system
8.	Study of clutch, Gear box and differential unit of the tractor
9.	Study of primary tillage implements: mould board plough and disc plough
10.	Study of secondary tillage implements- harrows and cultivators.
11.	Study of inter-culturing tools and implements- manual and animal drawn.
12 & 13	Study of seed-cum-fertilizer drill and calibration of seed drill.
14.	Study of sprayers and dusters
15.	Study of harvesting and threshing machinery
16.	Study of power tiller- important parts and attachments

Suggested Readings

- 1) Principles of Agricultural Engineering Vol. 1. Reprint Edition: 2012. by T. P. Ojha, A. M. Michael, Jain Brothers, New Delhi
- 2) Elements of Agricultural Engineering by JagadishwarSahay. Forth Edition, 2010 Standard Distributor and Publishers, New Delhi
- 3) Agricultural Engineering by O P Singhal (2011) Aman Publishing House, Meerut
- 4) Elements of Farm Mechaneries by A C Srivastava, Oxford and IBH Publishing Co Pvt Ltd, New Delhi
- 5) Farm Tractor -Repair and Maintenance by S.C. Jain and C.R. Rai.
- 6) Principles of Farm Machineies by R A Kepner, R Bainer, E C Barger (2000) CBS Publishers and Distributors, Delhi
- 7) Farm Engines and Tractors by H E Gulvin (2001) McGraw Hill, New York
- 8) Servicing and Maintenance of Farm Tractors (2005) E J Johnson and A HHollenburg, McGraw Hill, New York
- 9) Tractor Implement System by Alcock and Ralph (1986) Athe AVI Publishing Co. Inc Springer, New York

Course :	ENGG 243		Credit:	2(1+1)	Semester-IV
Course title:	Renewable Energy and Green Technology				

Syllabus

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.

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1	Classification of energy sources	4
2	Energy utilization pattern in crop production	5
3	Biofuels: Introduction, Ethanol production process, Biodiesel production process, Environmental Benefits	8
4	Biogas: Introduction, process description, Constituents of biogas, main features of biogas plant, Classification & Popular designs, Applications	8
5	Gasifier :Types of gasifier, Gasification process, Producer gas and its constituents	8
6	Bio-oil: Pyrolysis or Destructive distillation	5
7	Solar Energy: Introduction Collection and applications	6
8	Solar Energy Devices: Solar Cooker	6
9	Solar Water Heater	6
10	Solar Distillation (solar still)	6
11	Solar Dryer	6
12	Solar Pond	6
13	Solar Photo-voltaic System (SPV)	6
14	Wind energy (Introduction, characteristics, measurement equipment, conversion systems, uses of wind energy systems)	7
15	Some other Renewable Energy Sources: Ocean thermal energy conversion, Tidal energy, Geothermal Energy, Hydrogen Energy, Fuel cells, Hydroelectric.	7
16	Use of New and Renewable energy sources in energy conservation	6
	Total	100

b) Practical

Experiment	Topic
1.	Study of floating drum biogas plants.
2.	Study of fixed drum biogas plants
3.	Study of different types of gasifiers.
4.	Study of the production process of biodiesel
5.	Study of production process of ethanol.
6.	Study of Solar Photovoltaic fencing.
7.	Study of box type solar cooker.
8.	Study of parabolic cooker.
9.	Study of solar water heater.
10.	Study of solar dryer.
11.	Study of solar water pumping system.
12.	Study of solar lightning system.
13.	Study of solar photovoltaic system.
14.	Study of solar distillation system.
15.	Study of the solar pond.
16.	Visit to Renewable energy integrated plant.

Suggested Readings

1. Non-conventional Energy Sources by G. D Rai 5th Edition. KhannaPublishers, Delhi
2. Renewable Energy Theory and Practice by N.S. Rathore, N.L. Panwar, A.K. Kurchania. Himanshu Publications, Udaipur.
3. Handbook of Agricultural Engineering, ICAR Publication.
4. Solar Energy Utilization by G.D. Rai 5th Edition. KhannaPublishers, Delhi.
5. Solar Energy: Principles of Thermal Collection and Storage by S.P. Sukhatme& J.K. Nayak 3rd Edition. McGraw Hill Education, Delhi.
6. Principle of Renewable Energy – Twidell and Weir.
7. Principle of Energy Conversion. Culp A.W. 1991. McGraw Hill Pub. Co. Inc.
8. Dufee J.A. and Beckman W.A. 1986. Renewable Energy Sources. E and FA Spon. Ltd. London
9. Biotechnology and Other Alternative Technologies for Utilization of Biomass and Agricultural Wastes by AmlenduChakravarti.
10. Biogas Technology; A practical Handbook by K. C. Khandalwal and S.S Mahdi, 1986.

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

Syllabus

Theory

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

Practical

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

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1.	Green house technology - Green house technology: Introduction, History of green house, Advantages of green house, Green house effect.	6
2.	Types of Green houses-Types of Green houses: Green house type based on Shape, Utility, Construction and Covering materials	7
3.	Plant response to green house environment -Plant response to green house environment : Light, Temperature, Relative Humidity, Ventilation and Carbon di-oxide.	6
4.	Planning and Design of green house- Planning and Design of green house: Site selection and orientation, structural design and covering materials.	6
5.	Materials of construction - Materials of construction for traditional and low cost green house: Wood, G.I., aluminum, steel, R.C.C. and Glass	6

Lecture	Topic	Weightage (%)
6.	Irrigation Systems used in green house - Irrigation Systems used in green house: Rules of watering, Overhead Sprinklers , Drip irrigation system and Foggers (Mist spraying)	6
7.	Design criteria of green house for Cooling and Heating purposes - Design criteria of green house for Cooling and Heating purposes: Cooling - Natural ventilation, forced ventilation Heating- Heating system, solar heating system, Water & Rock storage.	6
8.	Engineering Properties - Engineering Properties of cereals, pulses and oil seed. Their applications in PHT equipment design and operation: Physical properties: Size and Shape (Roundness and Sphericity) Porosity, Coefficient of friction, and angle of repose, Thermal properties: Definition of Specific heat and Thermal conductivity. Aero & hydrodynamic properties: Definition of Terminal velocity	6
9.	Drying and Dehydration - Drying and Dehydration: Definition of drying and dehydration, Utilities/Importance of drying Grain drying Theory- EMC definition, Thin layer drying and deep bed drying	6
10 & 11	Moisture Measurements- Moisture measurements: Moisture content and its measurement, Moisture content representation: Dry basis and wet basis Moisture Content determination Methods:- Direct methods- Air oven method, Vacuum oven method and Infra-red method Indirect Methods- Electrical resistance method and Di-electric method .	12
12.	Various Drying Methods - Various Drying Methods: Sun drying, Mechanical Drying Mechanical Drying Methods:- Contact drying, Convection drying, Radiation drying	6
13.	Numerical on Moisture content and its representation- Numerical on Moisture content and its representation: Conversion of wet basis moisture contents to dry basis moisture contents Conversion of dry basis moisture contents to wet basis moisture contents, Problems on drying Problems on moisture contents Problem No.1 & No.2.	6
14 & 15	Commercial Grain Dryers - Commercial Grain Dryers: Construction and working principle - Deep bed dryer, Flat bed dryer, Recirculating dryer – (LSU and Baffle dryers) , Tray dryer and Solar dryers	13
16.	Material Handling Equipments- Material Handling Equipment's: Construction and working principle- Conveyor- Belt conveyor and Screw conveyor Elevator- Bucket elevator	8
	Total	100

b) Practical

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

Suggested Readings

- 1) Green House Technology & Management by K.RadhaManohar (2000) C.Igathinathane B.S. Publications 4-4-309, Sultan Bazar, Hyderabad-500095.
- 2) Unit Operations of Agricultural Processing by K.M. Sahay and K.K.Singh (2009)Vikas Publishing House Pvt. Ltd. New Delhi-110007
- 3) Post harvest Technology of Cereals, Pulses and Oilseeds by A. Chakraverty (1997)Oxford & IBH Publishing Co. Pvt. Ltd., 66 Janpath, New Delhi-110001.
- 4) Green House management by L R Taft (1997) Biotech Books, Delhi
- 5) Post Harvest Technology and Quality management of Fruits and Vegetables by P. Suresh Kumar, V R Sagar and M Kanwat (2009) Agrotech Publishing Academy, Udaipur
- 6) A Text Book of Greenhouse and Post Harvest Technology by B.P. Sawant, J.M. Potekar, H.W. Awari(2008) Nikita Publication, Latur.
- 7) Green House Technology by G. N. Tiwari and R.K. Goyal(1998) Narosa publishing House, 6 community Centre, Panchsheel Park New Delhi- 110017
- 8) Green House Technology and Application by V M Salokhe and A KSharma(2006) Agrotech Publishing Academy, Udaipur
- 9) Emerging Trends in PHT and Utilization of Plant Food by N Khetarpaul et al(2003) Agrotech Publishing Academy, Udaipur
- 10) Green House Operation and Management by Nelson and Paul V (1994) Prentice Hall, USA