

ANNEXURE I: SYLLABUS AGRICULTURAL ENGINEERING

UNIT -I : Workshop Technology, Engineering Mechanics and Material Testing

Different workshop processes; Carpentry – Tools for carpentry operations; Wood working machines; Fitting – Tools for fitting operations; Sheet metal work - Metals used, tools, operations; Foundry - Tools, materials, patterns, allowances, colour codes, moulding sand, moulding procedure, processes, defects; Drilling - Types, machines, operations; Lathe - Construction, functions, types, parts, accessories, operations, tools used in centre lathe; Production lathes, difference between centre lathe and turret lathe, types of turret lathe, capstan and saddle lathe, work and tool holding devices, operations, automatic and semi-automatic lathes, classification.

Mechanics – Definitions, application, units, basic concept of force; Composition and resolution of forces; Resultant of two concurrent forces, concurrent coplanar forces, couples; Classification and characteristics of a couple -Equilibrium and equilibrant, triangle law of forces, polygon law of forces, Lamis theorem; Common lifting machines - Inclined plane, lever, pulley block; System of pulleys; Ideal machine, reversible and irreversible machine, conditions for self-locking, frictional loss in machine, law of machine, maximum mechanical advantage, maximum efficiency. Centre of gravity, Moment of inertia; Engineering materials - Classification, importance selection, testing, tests; Extraction of iron, steel, raw material of iron, general survey.

UNIT -II : Principles of Thermodynamics and Heat Engines

Classification, properties, path, state of a system; Thermodynamic processes - Different ways to represent pressure and temperature; Energy - Types; Heat, work, power, enthalpy, entropy; Laws of thermodynamics; Fuels – Classification, properties; Heat engines - Types, classification, components, material of construction, functions; Diesel cycle (4-stroke), Otto cycle (4-stroke), 2-stroke cycle engines, petrol and diesel engines; Comparisons between petrol and diesel engines; Fuel supply system of IC engine - Types, components, functions; Ignition system of IC and SI engine - Components, functions, battery and magnetic ignition system; Cooling and lubrication system – Types, components, functions.

UNIT -III : Principles of Fluid Mechanics, Hydrology and Management of Watersheds

Fluids – Classification, properties; Fluid pressure measurement; Kinematics; Dynamics; Bemoulli's theorem and its practical applications; Flow through orifices, mouth pieces, notches, weirs; Flow through simple pipes - Darcy's formula, Chezy's formula.

Hydrology; Hydrologic cycle; Characteristics of rainfall in India; Recording and non-recording rain gauges; Probability analysis of rainfall, Weibull's method; Runoff – Components, runoff characteristics of streams; Measurement of stream flows; Hydrographs – Components, hydrograph separation, unit hydrograph, flood control; Watershed – Identification, delineation, physiographic characteristics; Watershed projects by different organizations.

UNIT -IV : Surveying and Levelling, Soil and Water Conservation Engineering and Practices

Surveying – Principles, classification; Chain Surveying – Instruments, operations, errors, corrections; Calculations of area; Compass survey – Traversing, local attraction, included angles; Levelling – Operations, classification, instruments, reduced levels, errors; Contouring - Methods, capacity of reservoir; Minor instruments; Theodolite survey; Trigonometric levelling; Tacheometric surveying; Curves; Electronic survey instruments; GPS; Digital planimeter; Total station.

Soil erosion - By water and wind; Measurement of runoff - Rational method, hydrologic soil cover complex method; Manning's equation in open channel; Estimation of soil loss; Erosion control measures - Contour bunds, graded bunds, grassed waterways, bench terraces, contour trenches; Drop spillways, drop-inlet spillways and chute spillways; Water harvesting; Land capability classification;

UNIT -V: On-Farm Irrigation and Drainage Practices and Micro Irrigation Principles and Practices

Sources of irrigation water; Surface irrigation methods; Drainage - Need, purpose, benefits, requirements; Interrelationship of irrigation and drainage; Types of drainage systems; Design of sub-surface drainage system, components.

Sprinkler irrigation – Components, types, moisture distribution patterns, uniformity, design, operation and maintenance; Drip irrigation – Components, hydraulics, types of emitters, design, installation, operation and maintenance, cost estimation.

UNIT –VI: Agricultural Implements and Agricultural Machinery

Tillage- objectives of tillage, primary tillage implements; Gathering, casting, etc.; Draft, unit draft, side draft, centre of power, centre of resistance, pull, line of pull, field capacity, field efficiency; Secondary tillage implements –Animal drawn and Tractor drawn implements: Puddlers, power tiller, tractor cage wheels; Planting and fertilizing equipment – Methods, classification, animal drawn and tractor drawn implements, seed metering mechanism; Furrow openers; Animal and tractor drawn seed-cum-fertilizers, calibration, zero till seed drill, paddy seeder, potato planter, sugarcane planter; Inter-cultivation implements (manual, bullock, tractor drawn); Wet and dry land weeders (star weeder, push hoes); Harvesting implements of groundnut, turmeric; Impact cutters.

Methods of paddy sowing, transplanting, transplanting machinery; Grain harvesting – Types, principles, manual harvesting, sickle, mechanical harvesting; Movers – Types, alignment, registration; Reapers – Types, reaper-cum-binder, performance, combine harvester; Corn harvesting equipment; Root crop harvesting equipment; Groundnut digger-cum-shaker, windrowers; Cotton harvesting machinery; Cotton strippers; Sugarcane harvesting machinery; Fruit harvesting machinery; Chaff cutter – Fly wheel type chaff cutter. Plant protection machinery – Sprayers, dusters, classification, calibration; Testing of agricultural machinery, test codes.

UNIT –VII: Greenhouse Technology, Principles of Electrical Engineering and Farm Electricity

Greenhouses Classification; Plant response to greenhouse environment; Environmental requirement for crops and control; Natural and forced ventilation; Summer and winter cooling systems, carbon dioxide enrichment method; Planning of greenhouse facility; Materials used for construction, covering materials; Design criteria and construction details greenhouses; Greenhouse heating and energy storage, irrigation systems, utilization in off-season; Protected agriculture techniques; Economics.

Conductor, insulator, semiconductor, terminology; Ohm's law, resistance, division of current; Electric power and energy; Heating effects, filament or incandescent lamp, fluorescent lamp, electric kettle, electric iron, space heater; Capacitance - Types, uses; Capacitors in series and parallel; Insulating materials; Farm electricity generation; Generators, motors and alternators, installation and maintenance; Transformer.

UNIT –VIII: Farm Power, Solar and Wind Energy, Tractor Systems, Operations and Maintenances

Farm power, sources; Renewable sources of energy, need, types; Solar Energy, solar constant, measurement of solar radiation, collection; Solar collectors – Non-concentrating types, flat plate collector, concentrating collectors; Solar energy storage – Methods, solar pond, applications; Solar power generation, solar space cooling, solar absorption refrigeration system; Solar space heating; Solar distillation; Solar dryers; Solar cooker; Photo voltaic conversion; Photo voltaic cell for power generation; Solar photovoltaic water pumping system, solar lantern, solar street light, solar fencing; Wind energy – Classification, designs; Wind mill for electric power generation, vertical axis wind mill, forces acting on the blade; Wind data and energy estimation, power coefficient, electrical generation.

Interaction, history classification; Tractor power transmission systems – Gear box, torque converter, differential unit, final drive, differential lock; Tractor steering unit; Braking system; Hydraulic system; Hitching system – Draw bar, 3-point hitch system, control board; Wheels and tyres – Traction; Mechanics of tractor chassis – Center of gravity; Repair and maintenance, testing; Power tiller, maintenance.

UNIT –IX: Solid Waste Utilization and Bio-Energy

Solid waste management; Recycling; Land fill; Bioenergy – Biomass; Biomass conversion technologies; Briquetting of biomass; Gasifiers – Operating parameters, types, construction, principle; Biogas – Principles, production, biogas plants; Constructional details of Deenabhandu biogas plant; Biofuels-Raw materials, characteristics; Biodiesel production; Ethanol production from sugarcane and corn.

UNIT –X: Engineering Properties and Processing of Seeds and Agricultural Process Engineering

Physical characteristics of different food grains; Rheology; Friction; Flow of bulk granular materials; Aerodynamics of agricultural products; Application of engineering properties in handling and processing machines and in storage structures; Seed processing concepts, machinery; Air screen cleaner; Length separator; Gravity or weight separator; Aspirators and pneumatic separator; Shape and roundness separator; Seed blending.

Scope and importance of crop processing; Cleaning and grading; Theory of separation, types, screen openings, cyclone separator; Drying; Moisture content measurement; Methods of drying; Sun drying; Continuous flow driers; Size reduction - Principles and theory, equipment; Filtration equipment; Material handling equipment; Grain storage structures; Threshing, types of threshers; Castor sheller, sunflower thresher; Winnowing; Rice Milling; Parboiling of paddy; Milling equipment; Wheat milling; Maize shelling and milling; Milling of pulses; Oilseed processing; Groundnut stripping, decortications.

ANNEXURE II**Number of questions to be set (each question carries one mark)****AGRICULTURAL ENGINEERING**

S. NO	TOPICS	MARKS
I	Workshop Technology, Engineering Mechanics and Material Testing	08
II	Principles of Thermodynamics and Heat Engines	05
III	Principles of Fluid Mechanics, Hydrology and Management of Watersheds	10
IV	Surveying and Levelling, Soil and Water Conservation Engineering and Practices	14
V	On-Farm Irrigation and Drainage Practices and Micro Irrigation Principles and Practices	10
VI	Agricultural Implements and Agricultural Machinery	14
VII	Greenhouse Technology, Principles of Electrical Engineering and Farm Electricity	08
VIII	Farm Power, Solar and Wind Energy, Tractor Systems, Operations and Maintenances	12
IX	Solid Waste Utilization and Bio-Energy	05
X	Engineering Properties and Processing of Seeds and Agricultural Process Engineering	14
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