

Paper –I [SYLLABUS FOR WRITTEN EXAMINATION]

AGRICULTURAL ENGINEERING

CODE NO: 280

UNIT-I: SURVEYING AND HYDROLOGY

Surveying – Instruments - Methods of surveying – Computation of area – Triangulation, intersection, traversing, cross staff survey – Plane table survey – Earth work computation -Simpson’s trapezoidal rule - Levelling - Definition - Types of benchmarks - Different types of levels – Reduction of leveling data by rise and fall method and height of collimation method -Contouring – Profile surveying - Cross section survey - Use of Minor instruments - Hydrology – Measurement of rainfall, evaporation and infiltration – Estimation of runoff – Factors affecting runoff – Computation of volume of runoff and peak flow – Unit hydrograph - Occurrence of ground water, hydraulics of wells, types of wells and their construction - Well drilling – Techniques for different formations - Well logging - Types of well screen - Design of well screens - Well development - Yield testing.

UNIT-II: SOIL EROSION AND CONSERVATION

Soil erosion – Types – Factors affecting erosion by water and wind - Stages of water erosion -Biological control measures - Biological control measures and their suitability - Contour farming, strip cropping, mixed cropping, intercropping and mulching - Mechanical control measures and their suitability – Design and construction of contour bunds, graded bunds, terraces, contour stone walls, contour trenches, staggered trenches and diversion drain - Gully control structures and check dams - Wind erosion – Types and control - Dry farming techniques for improving crop production - Estimation of soil erosion - Universal Soil Loss Equation.

UNIT-III: WATERSHED DEVELOPMENT AND MANAGEMENT

Watershed – Concept, types and delineation - Land capability classification - Participatory rural appraisal technique – Watershed development plan – Estimation of cost and benefits -Gully and ravine reclamation – In-situ & Ex-situ water harvesting, micro catchments – Ground water recharge - Farm pond and percolation pond – Selection of suitable soil and water conservation practices – Afforestation – Holistic planning - Watershed based rural development – Use of aerial photography and remote sensing in watershed management - Applications of GIS in planning and development of watersheds including forest cover and water resources.

UNIT-IV: IRRIGATION AND DRAINAGE

Irrigation - Sources – Soil- water- Plant relationship - Water requirement of crops– Measurement of irrigation water - Weirs and flumes - Methods of irrigation - Surface, sprinkler and drip irrigation - Drip irrigation – Components – Wetting pattern - Filters and Fertigation tanks - Design of laterals - Submain - Main lines -Pump capacity - Operation and

maintenance- Sprinkler irrigation - Components - Sprinkler performance - Hydraulic design of sprinkler systems - Duty and delta relationship - Irrigation scheduling - Irrigation efficiencies and their estimation - Pumps - Types, selection and installation - Drainage - Causes of water logging and salt problem - Methods of drainage - Design of surface, sub-surface and vertical drainage systems - Improvement and utilization of poor quality water - Reclamation of saline and alkali soils.

UNIT-V: FARM AND IRRIGATION STRUCTURES

Design and construction of farm structures - Site selection - Materials of construction - Quality- types of masonry - Foundation, basement and superstructure - Types of roofs - building plan and estimation, requirements of farm house, threshing floor, drying floor, poultry house, dairy farm, rat proof godown and farm roads - Design features earthen dams and gravity dams - Water conveyance structures - Earthen channels and lined channels - Advantages of lining - materials of lining - Design of channel cross section - Crossing control structures - Drop spillway, chute spillway, pipe inlet spill way - Road crossing structures - Culvert, inverted siphon aqueduct - Their uses - Underground pipe line system - Components and their functions - Structures for plant environment- Green houses, polyhouses and shadenets - Construction and utilization - Soil less culture.

UNIT-VI: FARM POWER

Agricultural mechanization - Scope and sources of farm power - Animate and electromechanical - Thermodynamics - Construction and working of internal combustion engines - Fuel, ignition, lubrication, cooling, air intake, exhaust, governing and electrical systems of IC engines - Different types of tractors and power tillers - Power transmission, ground drive, power takeoff, steering, brake, implement control and hydraulic systems - Bulldozer - Features, traction, suspension, steering, operations using bulldozer - Weight transfer, theory of traction - Tractive efficiency - Mechanics and stability - Care and maintenance of tractors.

UNIT- VII: FARM MACHINERY

Farm machinery - Primary tillage implements - Mould board plough, disc plough and chisel plough - Secondary tillage implements - Cultivators, harrows and rotary tillers - Land shaping machinery - Leveller, ridger and bund former - Sowing and transplanting - Seed drills, planters and rice transplanters - Interculture implements - Plant protection equipment - Sprayers and dusters - Harvesting, threshing and combining equipment - Machinery for earth moving and land development - Machinery for horticulture, agro-forestry and forages - Haulage of agricultural and forest produces - Management of farm machinery - Cost estimation for farm operations.

UNIT-VIII: UNIT OPERATIONS IN FOOD AND AGRICULTURAL PROCESSING

Heat transfer principles – Conduction, convection and radiation - Types of heat exchangers - Unit operations – Evaporators - Types - Mechanical separation – Filtration – Sedimentation – Settling – Centrifugal separation – Cyclone separation- Size reduction – Mixing – Blending – emulsification - Food processing operations- Pasteurization – Sterilization – Canning - Retort processing - Extrusion processing of foods - Methods of drying of foods – Preservation of food by irradiation - Microwave and dielectric heating - Fats and oil processing – Extraction methods and equipments - Food packaging – Materials and characteristics – Suitability - Processing of milk and milk products, packaging of milk - Principles of refrigeration and applications in food industries – Cold storage of fruits and vegetables - Design aspects.

UNIT- IX: PROCESS ENGINEERING OF AGRICULTURAL AND HORTICULTURAL CROPS

Engineering properties of food materials – Moisture content – Methods of determination – Psychrometry - Drying – Thin layer and deep bed drying – Types of heat sources and types of dryers - Cleaning and grading – Principles – Separators – Efficiency – Performance index - Shelling and decortication – Seed processing and layout of seed processing units - Rice processing – Parboiling and dehusking of paddy – Machines used - Milling of wheat, corn and pulses – Material handling equipments - Conveyors and elevators - Storage – Conditions for safe storage – Bag and bulk storage – Silo storage - Design aspects - Modified atmosphere storage – Storage structures - Equipments used for processing of horticultural crops – Preservation of fresh fruits and vegetables – Drying and dehydration – Processing of coffee, tea, rubber, cashew nut, coconut, oil palm, aromatic plants, flowers and spices.

UNIT-X: RENEWABLE AND BIOENERGY

Solar energy – Solar collectors – Air heaters – Water heaters – Solar photovoltaic systems and applications - Wind energy - Suitable sites – Types of wind mills – Wind mill components – Applications – Performance of wind mills - Biomass resources – Agro residues – Characteristics - Conversion technologies – Biochemical conversion – Biogas plant – Types and selection, construction, operation and maintenance - Slurry handling - Thermochemical conversion – Stoves – Types - Improved stoves – Pyrolysis – Charcoal production – Gasification – Briquetting – Cogeneration - Energy plantation and environmental impact – Global warming – Clean development mechanism (CDM) and role of afforestation - Biofuels – Biodiesel feedstock, production and by-product utilization – Ethanol – Production and utilization – Emission - Standards and control.