

Tamil Nadu Public Service Commission
Syllabus

Code No.164

Subject: Agricultural Engineering (Degree standard)

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 – reduction of leveling data by rise and fall method and height of collimation method. Contouring – profile surveying - cross section survey. Hydrology – measurement of rainfall, evaporation and infiltration – estimation of runoff – factors affecting runoff – computation of volume of runoff and peak flow – unit hydrograph.

Unit II: SOIL CONSERVATION

Soil erosion – types – factors affecting erosion by water and wind. Stages of water erosion. Biological control measures - 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. Estimation of soil erosion - Universal Soil Loss Equation.

Unit III: WATERSHED DEVELOPMENT AND MANAGEMENT

Watershed – concept, types and delineation. Land capability classification. Participatory watershed development plan – estimation of cost and benefits - gully and ravine reclamation – 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 – infrastructure development – use of aerial photography and remote sensing in water shed management. Applications of GIS in planning and development of watersheds, forests 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. Irrigation efficiencies and their estimation. Design and construction of canals, field channels, underground pipelines, head-gates, diversion boxes and structures for road crossing. Occurrence of ground water, hydraulics of wells, types of wells and their

construction. Pumps - types, selection and installation. Drainage - causes of water logging and salt problem. Methods of drainage - drainage of irrigated and unirrigated lands, 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 - construction procedure. 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. Under ground pipe line system – components and their functions. Structures for plant environment – green houses, polyhouses and shadenets – construction and utilisation.

Unit VI: FARM POWER

Agricultural mechanization – scope and sources of farm power - animate and electro-mechanical. 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. 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 – size reduction – mixing – blending – emulsification. Food processing

operations - pasteurization – sterilization – canning. 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. Processing of milk and milk products, packaging of milk. Principles of refrigeration and applications in food industries – cold storage of fruits and vegetables.

Unit IX: PROCESS ENGINEERING OF AGRICULTURAL AND HORTICULTURAL CROPS

Engineering properties of food materials – moisture content – psychrometry. Drying – thin layer and deep bed drying – types of heat sources. 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 – 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, cashewnut, coconut, oil palm, aromatic plants, flowers and spices.

Unit X: RENEWABLE AND BIOENERGY

Solar energy – solar collectors – air heaters – water heaters – cookers. 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.

Reference Books:

1. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Vol. I and Vol.-II. Jain Brothers, New Delhi.
2. Barger, E.L., J.B. Liljedahl and E.C. McKibben, 1997. Tractors and their power units. Wiley Eastern Pvt. Ltd., New Delhi.
3. Jain, S.C. and C.R.Rai, 1999. Farm tractors (Maintenance & Repair). Standard Publishers Distributors, New Delhi.
4. Sahay,K.M. and K.K.Singh. 2005. Unit Operations of Agricultural Processing, Vikhas Publishing House, New Delhi.
5. Chakravertry,A. 2000. Post Harvest Technologies of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Company, Calcutta.
6. Pande,P.H. 1994. Principles of Agricultural Processing. A Text Book, Kalyani Publishers, Ludhiana.
7. Rai,G.D. 1995. Non-conventional Sources of Energy. Khanna Publishers, New Delhi.