

Agricultural, Mechanical, Automobile and Civil Engineering**(Degree Standard)****Code: 562****Unit I: General Engineering (20 Questions)**

Statics of Particles, Equilibrium of Rigid bodies, Properties of Surfaces and Solids, Centroid, Centre of Gravity, Dynamics of Particles, Friction in Machine Elements, Stress, Strain and Deformation of Solids, Theories of Failures, Design of Shafts and Couplings, Fluid statics, equations of continuity and momentum, Bernoulli's equation, Flow through pipes, head losses in pipes, bends, Pumps and its applications, Valves and Types, Iron Carbide Phase Diagram, ferrous and nonferrous alloys, Heat treatment of ferrous and non-ferrous metal, Engineering and commodity polymers, composites, nano-materials, Foundry Technology- Metal Forming Processes, Metal Joining processes, Manufacturing of Thermo Setting and Thermo Plastic Products, Inventory control - Economic Order Quantity (EOQ) - quantity discounts, ABC Analysis, Operations Research, Assignment Model, Critical Path Method (CPM) and Program Evaluation Review Technique (PERT), Queuing Models, Industrial Safety.

Unit II: Surveying and Hydrology (20 Questions)

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

Unit III: Soil Erosion and Conservation (15 Questions)

Soil erosion – Types – Factors affecting erosion by water and wind - Stages of water erosion - 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 - Drop spillway, chute spillway, pipe inlet spill way and check dams - Wind erosion – Types and control - Wind breaks and shelter belts - Dry farming techniques for improving crop production - Estimation of soil erosion - Universal Soil Loss Equation.

Unit IV: Watershed Development and Management (15 Questions)

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 - Artificial recharge techniques and methods - 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 Remote sensing and GIS in planning and development of watersheds including forest cover and water resources.

Unit V: Farm Irrigation, Structures and Drainage (30 Questions)

Irrigation - Sources – Soil- water- Plant relationship - Water requirement of crops – Measurement of irrigation water - Weirs and flumes - Methods of irrigation - Surface, Sprinkler, Rain gun and drip irrigation - Irrigation automation - Drip irrigation – Components and design - Wetting pattern - Filters and Fertigation tanks - 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 - Design and construction of farm structures – Site selection – Quality – RCC - 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 go down 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 – Road crossing structures – Culvert, inverted siphon aqueduct – Their uses - Underground pipe line system – Components and their functions – Structures for plant environment – Green houses, poly houses and shade nets – Construction and utilization - Soilless culture. 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 VI: Farm Power (20 Questions)

Sources of Farm Power- Construction and working of Spark Ignition (SI) and Compression Ignition (CI) engines- Thermodynamic principles of SI and CI engine - Two stroke and Four stroke engines - Turbo charging – Fuel injection systems, Ignition, Lubrication and Cooling systems, Speed governors, Electrical systems of Internal Combustion engines - Different types of tractors, bull dozers and power tillers - power transmission systems, Types of Clutches and Gearboxes, Differential, Final drive system, Braking system – types, constructional details and operation, Steering system – types, constructional details and operation, Suspension system – types, constructional details, uses of hydraulic system in tractors, hitching system, three point linkage- tractor power outlets. Resistances to vehicle motion, vehicle performance

characteristics, Operations using bulldozer, Types of wheels and tyres – Battery: types, constructional details and working principle. Tractor stability - mechanics of tractor implement combination, weight transfer - Ergonomic considerations in operation of tractors, Safety devices in tractors, Maintenance of tractors. Single phase induction motor - three phase power measurement methods- Power factor Electrical pump sets - regulated DC power supply, DC machine, DC generator, DC motor, starter - torque and efficiency - Electronics in Agriculture - Semi -conductors, transistors, operational amplifiers – Digital electronics, counters, encoders, decoders, Digital to Analog and Analog to digital converter Instrumentation - transducers - strain gauges, types and gauge factor - force measurement using strain gauges, Torque measurement, pressure measurement, flow measurement temperature measurement, thermocouples, speed measurement microprocessors, microcontrollers, PID controllers, PLC - Electric vehicles in Agriculture.

Unit VII: Farm Machinery (20 Questions)

Earth moving equipment - Backhoe with front end loader, Crawler excavator - Bull dozer - bladeshovals-soil digging machines-primary tillage implements- indigenous plough, Mould board plough, disc plough, chisel plough, sub soiler, methods of ploughing – secondary tillage implements-cultivators, harrows, rotary tillers, rotavator, land shaping machinery- laser leveller, ridger, bund former, raised bed former, puddler. Calculation of field capacity and field efficiency. Sowing and transplanting –seed drills, types - different types of metering mechanisms, planters, broadcasters and rice transplanters, pneumatic planters- intercultural implements - dryland weeders, wetland weeders, manual and power operated weeders - plant protection equipments – sprayers - types of sprayers - Drone sprayer - calibration of sprayer, types of nozzles, drift – harvesters - sickle, mower, cutter bar, reaper, binders, windrowers - threshers - principle of threshing, types of threshers, threshing drums, calculation of output capacity, combines, working principles, components of combine. Root crop harvesters, cotton harvesters, cotton strippers, sugarcane harvester, maize harvesters, vegetable and fruit harvesters, crop residue management machinery - cost estimation of farm machinery.

Unit VIII: Unit Operations in Food and Agricultural Processing (20 Questions)

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 equipment - 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 (20 Questions)

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 corn, pulses and millets - Material handling equipments - Conveyors and elevators - Storage – Conditions for safe storage – Bag and bulk storage – Silo storage - Design aspects - Modified atmosphere storage – Storage structures - Equipment 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 (20 Questions)

Solar energy – Solar collectors – Air heaters - Solar dryers – Water heaters - Solar cold storage– Solar photovoltaic systems and applications- Solar PV pump, fencing - 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 – Alternate renewable energy systems - Hydro power, Geothermal, ocean and hydrogen energy- Energy storage systems- Energy Conservation- 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.