

SYLLABUS FOR LAB ASSISTANT
(AGRICULTURAL & MACHINERY)

Diploma in Agricultural Engineering

1. **Basics of Agriculture:** Origin of Soil, Soil Forming Process, Classification of Soil, Physical Properties of Soil, Essential Plant Nutrients, Soil Fertility, Soil Productivity, Acid Soil, Saline Soil and Alkaline Soil. Methods of Fertilizer Application to Crops, Descriptive idea of Grain size classification and Indian standard soil classification Sieve analysis, Stock's law and hydrometer analysis (Basic concept only) Darcy's law Constant head permeo meter Variable head permeo meter. Classification of Crops, Intercropping, Mixed Cropping, Relay Cropping Mixed Cropping. Effect of Weather Parameters on Crop Growth and Development, Soil-Water Plant Relationship, Weed Management, Cropping Systems, Planting Methods, Propagation Methods.
2. **Soil Water and Conservation Engineering:** Scope of soil and water conservation. Mechanics and types of erosion, their causes. Rainfall, runoff and sedimentation relationships and their measurement. Soil erosion control measures – biological and engineering including stream bank protection vegetative barriers, contour bunds, contour trenches, contour stone walls, contour ditches, terraces, outlets, and grassed waterways. Gully control structures – temporary and permanent – design of permanent soil conservation structures such as chute, drop and drop inlet spillways. Principles of flood control – flood routing. Watershed Management – investigation, planning, and implementation – selection of priority areas and water shed work plan, water harvesting and moisture conservation. Wind Erosion process – design for shelter belts and wind brakes and their management.
3. **Irrigation and Drainage:** Sources of water for irrigation. Planning and design of minor irrigation projects. Techniques of measuring soil moisture – laboratory and in situ, Soil-water plant relationships. Water requirement of crops. Planning conjunctive use of surface and ground water. Measurement of irrigation water, measuring devices – orifices, weirs, and flumes. Methods of irrigation – surface, sprinkler and drip, fertigation. Irrigation efficiencies and their estimation. Occurrence of ground water, hydraulics of wells, types of wells (tube wells and open wells) and their construction. Rehabilitation of sick and failed wells. Pumps-types, selection, and installation. Drainage causes of waterlogging 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.

147
21

112

4. **Farm Power and Machinery:** Agricultural mechanization and its scope. Sources of farm power – Animal, Electrical, Mechanical, Solar (thermal and photovoltaic), wind and bio-gas energy and their utilization in agriculture. Thermodynamics, construction and working of internal combustion engines. Fuel, ignition, lubrication, cooling, and governing system of IC engines. Different types of tractors and power tillers. Power transmission, power take off and control systems- steering brake and hydraulics system of tractor. Introduction to machines used for primary tillage, secondary tillage, rotary tillage, and minimum tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, Puddler, cultivators, identification of major functional components. Attachments with tillage machinery- Hitching systems and controls of farm machinery. Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills. Introduction to planters, bed planters and other planting equipment like sugarcane, potato. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation. Calculation of field capacities and field efficiency. Calculations for economics of machinery usage.

5. **Agricultural Process Engineering:** Post harvest technology of crops and its scope. Cleaning grading and Size Reduction- Seed and grain cleaning and grading equipment Width and roundness, shape and weight-based separator, horizontal separator, disk separator, gravity separator, rotary cleaner their principles of operations and working. Drying- equilibrium moisture contents, Principles of drying, drying process, Constant ratio period and falling rate period, Solar drying Direct and indirect dryer. Milling- Principles of operation of Pulse and rice mills. Storage- Traditional, improved, modern storage system. Material handling equipment – belt and screw conveyors, bucket elevators, their capacity and power requirement. Processing of milk and dairy products – homogenization, cream separation, pasteurization, sterilization, spray, and roller drying, butter making, ice cream manufacture.

6. **Surveying and Levelling:** Principles of Surveying, Method of chaining, Ranging, Chaining on slope, Plotting- Selection of Scale, Conventional Signs, Plotting on Drawing sheet from field Book Data. Principles of Traversing-Open & Closed Traverse, Advantages & Disadvantages Over Chain Surveying. Concepts of Level

711
148
20

Surface, Horizontal Surface, Vertical Surface, Datum, R.L, B.M. Leveling Staff-Types, Features and Use. Computation Problems on computing area from field notes, Computation of area from field plan, The mid ordinate rule, Simpson's rule, Formula for calculation of volume.

7. **Workshop Technology:** Crystal structure, unit cell & space lattice, metallic, space lattice, effect of grain size on properties of metals. Welding, definition, types of electrodes, fluxes welding defects, gas cutting. Soldering- types of solder, soldering Iron. Brazing- types of brazing, Atal's, fluxes. Carpentry tools and processes- Band saw, wooden lathe circular saw, wood planner. Blacksmithy shop tools and their uses- Different forging operations, Defects of forging. Welding- types of welding, types of welding joints, edge preparation, welding techniques.
8. **Refrigeration and Air-Conditioning:** Refrigeration, Refrigerant, COP, Air Refrigeration system- components, working & applications. Vapour Compression system: components, working & applications. Air conditioning; Classification of Air-conditioning systems. Comfort and Industrial Air-Conditioning. Window Air-Conditioner. Summer Air-Conditioning system, Winter Air-Conditioning system, Year-round Air-Conditioning system.
9. **Fluid mechanics & Hydraulic machinery:** Properties of fluid: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity. Pascals law of Fluid pressure. Fluid Flow- Types of fluid flows, Path line and Stream line, streak line, stream tube, potential line, Bernoulli's theorem, Principle of operation of Venturi meter, Orifice meter and Pitot tube. Reynolds number, Froud number and Webber number. Equation of continuity for one-dimensional steady flow. Difference between notch and weir, Nappe or vein, crest or sill of a notch, classification of weirs, rectangular weir, triangular weir, trapezoidal weir, Submerged weir – Anicut raised weir, barrage, broad crested weir, ogee weir. Centrifugal Pumps- Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitation, Manometric head, Work done.

240

145
19

SYLLABUS FOR WRITTEN TEST FOR THE POST OF SURVEYOR (CIVIL ENGINEERING)

18. Basic knowledge of Auto CAD