

## **Agricultural Engineering (Instructor)**

### **1. General Agriculture and Agricultural Engineering.**

- 1.1 Principles of Crop Production (cereals, pulses, oilseed, cash crops, vegetables, and fruits)
- 1.2 Plant Physiological Process
- 1.3 Soil fertility, properties and classification
- 1.4 Soil-water -plant relationship: infiltration, evaporation, transpiration and consumptive use, and evapotranspiration (ET) estimation methods
- 1.5 Crop water requirements, irrigation frequencies, and irrigation effectiveness
- 1.6 Irrigation and drainage methods (furrow irrigation, border irrigation, check basin irrigation, sprinkler and drip/tickle irrigation, surface and sub-surface drainage system)
- 1.7 Soil erosion (rain drop erosion, rill erosion, gully erosion, stream channel erosion) and their control measures (engineering and bioengineering methods)
- 1.8 Human, animal, electrical, and mechanical powers
- 1.9 Introduction to primary and secondary tillage implements
- 1.10 Planting, harvesting, threshing machines, and pumps

### **2. Surveying**

- 2.1 General: Classifications; Principle of surveying; Selection of suitable method; Scales, plans and maps
- 2.2 Leveling: Methods of leveling; Leveling instruments and accessories; Principles of leveling
- 2.3 Theodolite and Traverse surveying: Temporary adjustments of theodolites; Fundamental lines and desired relations; Tachometry- stadia method; trigonometrically leveling; Checks in closed traverse
- 2.4 Contouring: Characteristics of contour lines; Method of locating contours; Contour plotting
- 2.5 Layout: Small buildings; Simple curves

### **3. Construction Materials**

- 3.1 Stone: Formation and availability of stones in Nepal; Methods of laying and construction with various stones
- 3.2 Cement: types, Ingredients, properties and manufacture; Admixtures
- 3.3 Clay and Bricks: type, manufacture, laying, bonds
- 3.4 Paints and Varnishes: type and selection; preparation techniques; use

#### **4. Mechanics of Materials and Structures**

- 4.1 Mechanics of Materials: Internal effects of loading; Ultimate strength and working stress of materials
- 4.2 Mechanics of Beams: Relation between shear force and bending moment; Thrust, shear and bending moment diagrams for statically determinate beams under various types of loading
- 4.3 Simple Strut Theory

#### **5. Hydraulics**

- 5.1 General: Properties of fluid; mass, weight, specific weight, density, specific volume, specific gravity, viscosity; Pressure and Pascal's Law
- 5.2 Hydro Kinematics and Hydro Dynamics: Energy of flowing liquid; elevation energy, kinetic energy, potential energy, internal energy
- 5.3 Measurement of Discharge: Weirs and notches; Discharge formulas
- 5.4 Flows: Characteristics of pipe flow and open channel flow

#### **6. Soil Mechanics**

- 6.1 General : Soil types and USCS soil classification; Three phase system of soil; Unit weight of soil mass- bulk unit weight, saturated unit weight, submerged unit weight and dry unit weight; Interrelationship between specific gravity, void ratio, porosity, degree of saturation, percentage of air voids air content and density index
- 6.2 Soil Water Relation: Darcy's law; Factors affecting permeability
- 6.3 Compaction of Soil: Factors affecting soil compaction; Optimum moisture content; relation between dry density and moisture content
- 6.4 Earth Pressures: Active and passive earth pressures
- 6.5 Foundation Engineering: Terzaghi's general bearing capacity formulas and their application

#### **7. Structural Design**

- 7.1 R.C Section in Bending: Under reinforced, over reinforced and balanced sections
- 7.2 Shear and Bond for a R.C Section: Shear resistance of a R.C section; Types of shear reinforcement
- 7.3 Axially Loaded R.C. columns: Short and long columns
- 7.4 Design and Drafting of R.C. Structures: Singly and doubly reinforced rectangular beams; Simple one way and two way slabs; Axially loaded short and long columns

## **8. Building Construction Technology**

- 8.1 Foundations: Subsoil exploration; Type and suitability of different foundations- shallow and deep; Shoring and dewatering
- 8.2 Walls: Type of walls and their functions; Choosing wall thickness, height to length relation; Use of scaffolding
- 8.3 Damp Proofing: Sources of dampness; Remedial measures to prevent dampness
- 8.4 Concrete Technology: Constituents of cement concrete; Grading of aggregates; Concrete mixes; Water cement ratio
- 8.5 Factors affecting strength of concrete
- 8.6 Form work
- 8.7 Curing

## **9. Soil and Water Engineering**

- 9.1 Water Conveyance and Control: Design of open channels, channel linings, drop structures and spillways, water control and division structures; Design of underground pipe conveyance system
- 9.2 Land Development: Land leveling-grading design methods, estimation of earthwork quantities, leveling and grading procedures, equipment for land grading and field layout
- 9.3 Ground Water, Irrigation Wells and Pumps: Design of wells; Wells construction procedures; Indigenous water lifting devices, positive displacement pumps, centrifugal pumps, vertical turbine pumps, submersible pumps, propeller and mixed flow pumps, selection of pumps and their performances, repaired and maintenance
- 9.4. Conservation structures, watershed management and water harvesting techniques

## **10. Farm Structure Development**

- 10.1 Planning of farmstead, farm residence, water supply and sanitation
- 10.2 Farm road, farm fencing, farm ponds, farm irrigation and drainage
- 10.3 Animal Shelters: Dairy barn (housing requirements, stanchion and loose housing barns with milking barn, pen barn); Poultry housing (housing requirements, types of poultry house, brooder house; Sheep and goat housing (types, housing requirements, construction material, layout); Swine housing (types, housing requirements, construction materials, layout); Aqua cultural engineering (types, pond construction)
- 10.4 Storage Structures: Fodder storage structure, feed storage structure, food grain storage structure, indigenous storage structure, bag storage structure, grain bins, and modern godown; Farm machinery storage structure and farm workshop
- 10.5 Farm and Rural Electrification: Power transmission and distribution, house wiring and its components; AC motor (single phase and poly phase), starters, selection of electric motors, care and maintenance of electric equipments; Micro-hydro power plants

## **11. Estimating and Costing**

- 11.1 General: Main items of work; Units of measurement
- 11.2 Rate Analysis: Basic general knowledge of the use of rate analysis and norms
- 11.3 Specifications: Interpretation of specifications
- 11.4 Valuation: Methods of valuation

## **12. Rural Engineering**

- 12.1 Green Roads
- 12.2 Water Supply and Sanitation Engineering (Source of water and its selection: gravity and artisan springs, shallow and deep wells; infiltration galleries)
- 12.3 Bio engineering Measures
- 14.4 Renewable Energy