457

AGRICULTURAL ENGINEERING

Paper I

Time Allowed : Three Hours	Maximum Marks : 200

INSTRUCTIONS

Candidates should attempt questions 1 and 5 which are compulsory, and any THREE of the remaining questions selecting at least ONE question from each Section.

All questions carry equal marks.

Answers must be written in ENGLISH only.

Assume suitable data, if necessary, and indicate the same clearly.

Neat sketches may be drawn, wherever required.

SECTION A

1. Answer any four of the following, not exceeding 150 words for each :

   (a) What is the importance of measurement of soil losses from area under controlled conditions ? List the devices that can be used for measuring runoff and sediment outflow from runoff plots. **10**

   (b) Define Universal Soil Loss Equation and discuss in brief its applications. **10**

(c) Discuss biological measures suitable for soil erosion control. *10*

(d) What is a diversion drain ? How are diversion drains designed ? *10*

(e) Compute the value of earthwork made and percentage area lost during the construction of bund on 40 ha land, which has slope of 3·2%. The details of bund are below : *10*

- Vertical Interval (VI) = 2·0 m

- Base width = 3·0 m

- Top width = 0·75 m

- Height of bund = 1·5 m

2. (a) Compare Broad based Terraces and Narrow based Bunds in their functioning, construction and maintenance. *10*

(b) List different methods available for Gully Control. Describe them in brief. *10*

(c) Discuss in brief the utility of Farm Ponds. List different types of Farm Ponds depending upon the source of water and their location with respect to land surface. *10*

(d) Calculate the spacing and the number of spurs to control a stream bank of 240 m length both sides, if the length of spur is 9 m and angle of projection is 30° from the top. *10*

3. (a) Discuss in brief the following terms :   *8*

      (i)   Mean Annual Rainfall

      (ii)   Rainfall Intensity

      (iii)   Frequency of Rainfall

      (iv)   Relationship between Intensity and Duration of Rainfall

    (b) Describe briefly the Rational Formula for estimating peak runoff rate from a watershed.   *12*

    (c) For calculation of earthwork in land grading, discuss the Four Point Method for determining the volume of cut-fill. What are the recommended cut-fill ratios for fine textured, coarse textured and organic soils ?   *10*

    (d) Differentiate among hydrologic, hydraulic, and structural designs used in the design of a structure. Discuss the check(s) against sliding in structural design.   *10*

4. (a) Differentiate between spectral band and revisit cycle.   *5*

    (b) Write short notes on : $2\frac{1}{2} \times 4 = 10$

      (i)   Unsupervised and Supervised Classifications

      (ii)   NDYI

      (iii)   NDVI

      (iv)   Electromagnetic spectrum

    (c) Describe briefly three segments of a Satellite system.   *6*

(d) Discuss in brief the following methods for determining the capacity of Farm Pond : **10**

    (i)   Trapezoidal rule

    (ii)   Simpson rule

(e) What is a grassed waterway and how is it designed ? **9**

SECTION B

5. Answer any *four* of the following, not exceeding 150 words for each :

(a) An irrigation stream of 24 litres per second is diverted to a check basin of size 10 m × 8 m. The water holding capacity of the soil is 13%. The average soil moisture content in the crop root zone prior to applying water is 6%. How long should the irrigation stream be applied to the basin to replenish the root zone moisture to its field capacity, assuming no loss due to percolation ? The average depth of crop root zone is 1·2 m. The apparent specific gravity of the root zone soil may be assumed to be an appropriate value.   *10*

(b) What are the hydraulics of wells ? List important properties of the aquifer material that influence the water holding and water transmitting characteristics of the aquifer.   *10*

(c) Describe in brief Warabandi system of water allocation in canal irrigation.   *10*

(d) Define Most Economical Channel Section. Derive an equation for the most economical channel section for a rectangular cross section having bottom width 'b', and depth 'd'.   *10*

(e) Differentiate between Mole drain and Tile drain. Briefly describe layout of different types of tile drain system.   *10*

6. **(a)** Differentiate the following : 8

   (i)   Specific yield and Specific storage

   (ii) Permeability and Transmissibility

   (iii) Unsteady flow and Steady flow

   (iv) Uniform flow and Non-uniform flow

(b) An engine driven pump is installed in an open well. The discharge obtained from the pump was 10 litres per second. The static water level was 15 m and the pumping water level was 18 m from the ground level. The total losses due to friction in pipes and accessories may be assumed to be 15 percent of the total static water head. What should be the horse power required for lifting the water ? If the pump efficiency is 60 percent and drive efficiency is 80 percent, calculate the BHP of the engine required to drive the pump. 12

(c) Differentiate between the following with the help of neat sketches :

   (i)   Direct and Reverse circulation hydraulic rotary.

   (ii) Volute and Diffuser types of pump. 2×5=10

(d) Discuss in brief the Orifice and Parshall Flume devices used for measuring irrigation water. What are their relative merits and demerits ? 10

7. (a) List sequencewise the important components of sprinkler system installed on the farm for irrigating the crop. Give a relation to determine the capacity of the sprinkler system. *12*

   (b) Differentiate the following : *8*

   (i) Water application efficiency and Water storage efficiency.

   (ii) Crop water use efficiency and Field water use efficiency.

   (c) Define sub-surface drainage. List benefits of sub-surface drainage. Discuss in brief sub-surface drainage methods. *10*

   (d) What is the difference between Observation well and Piezometer ? Discuss in brief their practical utility. *10*

8. (a) Define Fencing. List different types of fencing. What type of fencing should be used for *10*

   (i) Experimental research farm

   (ii) Poultry yard

   (iii) Farm boundary

   (iv) Pasture land

   (v) Implement shed

(b) Determine the size of an overhead tank for a farmstead demanding a maximum of about 50,000 litres of water per hour for two hours during noon and 30,000 litres of water per hour during the rest of the period. The tubewell is capable of supplying water at the rate of 10 litres per second. *10*

(c) Describe in brief Green House, Poly House and Shade House from construction point of view. How can the use of drip irrigation in poly houses be beneficial in raising vegetable crops ? *10*

(d) Sand used in construction should be free from organic matter and clay. Discuss the tests which can be performed quickly to find these impurities. *10*