

Time : 3 hours

Full Marks : 200

Instructions :

- (1) The figures in the right-hand margin indicate full marks for the questions.
- (2) There are two Sections (Viz. Section—A and Section—B). Seven questions are in each Section.
- (3) Attempt any five questions from each Section.
- (4) Use Separate Answer booklets for Section—A and Section—B.

SECTION—A

1. (a) Discuss the dominant mechanisms of soil erosion in high rainfall areas like the North-East India, and in dry areas like the deserts in Rajasthan. 10
- (b) With the help of labelled diagram, discuss the working principle of a Parshall flume. 10
2. (a) Explain the hydrologic cycle. What is meant by hydrograph? 3+3
- (b) Estimate the excess runoff to be disposed of through the outlet of a contour bund using the following data : 14
 - land slope : 2%
 - top width of bund : 0.5 m
 - height : 0.6 m
 - height of crest above ground level : 0.3 m
 - slope of bund : 1.5 : 1
 - VI : 0.85 m
 - length of bund : 250 m
 - intensity of rainfall for a 10-year recurrence interval and for the time of concentration : 80 mm/h

- constant infiltration rate
during the peak rainfall : 25 mm/h
- storage behind the bund
before the peak rainfall : nil

3. (a) Describe in brief various methods of irrigation. 5

(b) A sprinkler irrigation system is designed to deliver a design daily irrigation requirement of 7 mm and a desired depth of 15 mm. Ten numbers of 250 m long laterals, with sprinklers in a 12.5 m square-spacing pattern are operated simultaneously to irrigate 25 ha field.

Determine—

- (i) maximum time between successive irrigations;
- (ii) the sprinkler system capacity required for a set length of 8 hours.

Assume that 1 hour is required to move each lateral in a set and application efficiency is 80%.

15

4. (a) Describe in brief various methods of drainage. 5

(b) Estimate the discharge capacity of a parabolic grassed waterway using following data :

- top width of flow : 7.5 m
- depth of flow : 0.3 m
- bed slope : 3%
- roughness coefficient
of grass : 0.04 m

Also estimate the percentage change in the discharge capacity of the channel section if with the passage of time, the roughness coefficient of grass is changed to 0.045.

8+7

5. (a) Explain the following terms : 6

- (i) Infiltration
- (ii) Runoff

- (b) Soil under consideration has a water table condition i.e., equilibrium water table depth 600 mm below ground level. One 125 mm diameter outer hole is drilled to a depth of 1 m below the ground level. An impermeable bed is located at a depth of 25 m below the ground level. Determine the hydraulic conductivity of the above soil if the water table rises from 120 mm to 200 mm in 22.5 seconds. Also calculate the time required for the water level to rise from 1.0 m to 1.25 m level assuming constant hydraulic conductivity as 1. 7+7
6. (a) Explain the terms (i) hydraulic gradient and (ii) hydraulic conductivity. 3+3
- (b) Calculate the diameter of a tile drain system, if the peak discharge, which has to be drained through the tile drain when it just flows full, is given by
- $$Q = 6.0 \times 10^{-4} S^{0.5} n^{-1}$$
- where
- Q = discharge, m^3/s
 S = drain bed slope (fraction)
 n = Manning's roughness coefficient
- Assume appropriate data where required. 14
7. (a) Explain important factors to be considered for selecting construction materials of farm buildings. 6
- (b) Discuss the disadvantages of using steel as materials for construction of farm structures. 6
- (c) In a concrete mixture of 1 : 3 : 5, twenty-four m^3 of sand were recommended to be used in putting up of a foundation of a building. Estimate the volumes of the other two components of the mix. 8

SECTION—B

8. (a) With the help of labelled sketch, describe the working of the fuel supply system of a modern farm tractor. 8
- (b) State the differences between dry and wet type air cleaner used in tractor. 4
- (c) How is a spark ignition different from compression ignition? Also discuss the following properties of diesel fuel : 4+4
- (i) Kinematic viscosity
- (ii) Cetane rating

9. (a) What could be the maximum drawbar pull of a tractor operating at a forward speed of 5 kmph if the 3-cylinder 4-stroke cycle engine of the tractor has the following specifications? 8
- bore diameter : 110 mm
 - stroke : 125 mm
 - rated speed : 2000 r.p.m
 - mean effective pressure : 440 kPa
 - mechanical efficiency of the engine : 75%
 - power loss between crankshaft and axle of the tractor wheel : 5%
 - tractive efficiency : 75%
- (b) Why are lubrication system and cooling system provided in tractor engine? 8
- (c) State the difference between three-point and two-point hitch systems of tractor. 4
10. (a) With the help of neat sketch, discuss the construction and working of a tractor drawn rotavator. 6
- (b) What should be the recommended speed of a 1.6 m disc harrow to cover 4 ha of land per hour? Assume overall field efficiency of the harrow operation as 80%. Also describe the reasons, why theoretical field capacity differs from actual field capacity of a field operation. 4+4
- (c) With the help of neat sketch, explain the weight transfer phenomena of a tractor implement system. 6
11. (a) Why is seed drill calibrated? Explain the procedure of seed drill calibration? 3+5
- (b) With the help of neat sketch, explain the different metering mechanisms of seed planter. 6
- (c) State different methods of planting and explain any two of these methods. 6

12. (a) In case of a power thresher, give reasons of the following : 3+3
- (i) Excessive grain damage
 - (ii) Excessive unthreshed grain
- (b) State the names of different types of plant protection equipment used in crop production and explain the working principle of any one of the plant protection equipments. 4+6
- (c) What precautions should be taken to ensure minimum damage to the environment while using plant protection machinery? 4
13. (a) List the essential items required for electrification of a farm with following electrical loads : 9
- (i) Household with 1 kW connected load for lighting and fan
 - (ii) Irrigation pump with 2 kW pump
 - (iii) 0.25 kW load for operation of miscellaneous motor loads.
- (b) List the different sources of farm power used in a typical farm of Arunachal Pradesh. 5
- (c) Explain the differences between two-phase and three-phase electrical connection. 6
14. (a) What are the different types of electrical motors used in agriculture? With the neat sketch, explain the working of a typical electrical motor. 4+6
- (b) Estimate the annual bill with the following electrical loads of a farm : 6
- (i) 10 numbers of CFL bulbs each with 10 watt operated for 5 hours per day
 - (ii) One 2 kW motor operated for 300 hours in the year with an average loading factor of 0.6.
- Consider electricity charge as Rs. 500 per unit.
- (c) Do you believe the length and diameter of the electrical cable are important considerations for electrical network in a farm? Explain. 4

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