

CSM – 12/16

Agricultural Engineering

Paper – I

Time : 3 hours

Full Marks : 300

The figures in the right-hand margin indicate marks.

Candidates should attempt Q. No. 1 from Section – A and Q. No. 5 from Section – B which are compulsory and three of the remaining questions, selecting at least one from each Section.

SECTION – A

1. Answer any three of the following :

(a) The topographic survey of a field gave the following elevations in meters at grid points :

[20]

Stations	Lines				
	1	2	3	4	5
A	10.56	10.34	10.02	9.84	9.76
B	10.37	10.24	9.98	9.68	9.57
C	10.22	10.04	9.94	9.56	9.48
D	9.92	9.84	9.76	9.31	9.02

Calculate the elevation of the centroid of the field. Stakes are to be put to guide the leveling of this field into a rice field. Calculate the cut or fill at the grid points.

- (b) Explain, in detail, the physical meaning and significance of the Reynolds number and Froude number in open channel and pipe flow.

[20]

- (c) Design a trapezoidal open ditch to drain 500 ha of land, having a drainage coefficient of 3 cm/day. The soil is silt loam (side slope = 1.5 : 1, maximum permissible flow velocity – 0.5 m/s) and maximum permissible slope of the channel bed is 0.1%. Assuming Manning's $n = 0.04$.

[20]

- (d) A farmer desires to raise the moisture content in a field from 16% to a field capacity at 24% by dry weight basis during irrigation. Each plot is divided into 0.2 ha border strips that is required to be irrigated in 40 minutes with an application efficiency of 75%. Determine :

[20]

- (i) The HP requirement with a pumping plant efficiency of 60% and conveyance

efficiency of 85%, supplying an adequate discharge of water against a total head of 20 m.

- (ii) The cost of irrigation for each strip if the electrical charges are @ Rs. 2.0 per kWh. Assume root zone depth 0.9 m and apparent sp.gr. 1.4.

2. (a) Estimate the time in hours required to give a 5 cm irrigation to border strip 125 m long and 5.5 m wide with a discharge of 10 lps from a tube well. Assume the water conveyance efficiency to be 75%. [15]
- (b) Explain the various low cost measures of seepage and percolation loss control in farm ponds and earthen irrigation channels. [15]
- (c) Write the status and implementation of micro irrigation system in Odisha. What are the frequent field problems faced by farmers in this regard? [15]
- (d) What is the philosophy of Participatory Irrigation Management? Describe the status and execution of it in Odisha. [15]
3. (a) Compare "Height of Instrument" method with "Rise and Fall" method. [15]

- (b) Explain the important considerations and criteria for selection of irrigation pumps. Discuss characteristics curves of centrifugal pumps. [15]
- (c) Compare the Chezy's, Manning's and Darcy-Weisbach formula for design of earthen irrigation channel and correlate the resistance coefficients used in these formulae. [15]
- (d) How do you determine the water requirement of crops ? Discuss the various factors affecting it. [15]
4. (a) Determine the size of the tile required at the end of a 500m long tile line. If the drainage coefficient is 1 cm, grade is 0.3% and the tile spacing is 50 m. [15]
- (b) Define Drainage Coefficient. A drainage canal discharges $0.2 \text{ m}^3/\text{s}$ and drains 250 ha. What is the drainage coefficient of this land ? [15]
- (c) Explain the hydrologic and hydraulic design of surface and sub-surface drainage system. [15]
- (d) Define vertical drainage, mole drain, bio-drainage and interceptor drain. [15]

SECTION – B

5. Answer any **three** of the following :

- (a) How you differentiate the role of farm ponds and percolation ponds in alleviation of drought and submergence of agricultural land ? **[20]**
- (b) Define confined and unconfined aquifer, recharge well, perched water table, drainable porosity and ground water exploration. **[20]**
- (c) Describe the land use capability classification in Indian conditions and in your state. **[20]**
- (d) How do you design grain storage structure and storage structures for semi perishables ? **[20]**

6. (a) A well penetrating an aquifer, underlain and overlain by impermeable layers was tested with a uniform discharge of 1,000 liters/min. The steady state drawdowns measured in two observation wells (1 m and 10 m radial distances from the center of the pumped well) were 13.4 m and 4.2 m respectively. Determine the hydraulic conductivity and transmissibility of the aquifer, if its saturated thickness is 10 m. **[30]**

- (b) Explain the various farming systems prevailing in your state, stating the merits and demerits. **[15]**
- (c) Write an essay on the role of remote sensing and GIS in watershed planning. **[15]**
7. (a) Present the critique of the vegetative and mechanical measures to control soil erosion. **[15]**
- (b) Explain how the flow nets can be used to determine groundwater flow. Also derive the equation for estimation of groundwater flow velocity. **[15]**
- (c) A straight gravity masonry dam of trapezoidal section has a top width of 1.6 m, base width of 3.2 m and a height of 6.2 m. the water impounding height is 5.6 m. the coefficient of friction is 0.5, the bearing capacity of soil is $25,000 \text{ kg/m}^2$. Test the structural stability of the dam. **[30]**
8. (a) Explain, in brief, the SCS curve number technique (Hydrological Soil Cover Complex Method) of estimation of surface runoff from small agricultural watersheds. **[15]**

- (b) Describe, in brief, how small and marginal rainfed farmers become prosperous by adopting rainwater harvesting based integrated farming in your state. **[15]**
- (c) Design a stanchion barn for 50 cows. Draw the floor plan, indicating various portions. Also, list out various building materials required for the construction. **[10]**
- (d) Design a farm house for 4 member family. Draw the floor plan. **[10]**
- (e) Describe, in brief, various types of poultry houses. Which type is more common in Odisha and why? **[10]**



- (a) Describe in brief how you would design a reinforced concrete beam for 50 kN/m. Draw the floor plan, indicating various portions. Also, list out various building materials required for the construction. [10]
- (b) Design a beam for a 50 kN/m load. Draw the floor plan. [10]
- (c) Describe in brief, various types of roof trusses. Which type is more common in Odisha and why? [10]

