

AGRICULTURAL ENGINEERING

PAPER—I

Time Allowed : Three Hours

Maximum Marks : 200

QUESTION PAPER SPECIFIC INSTRUCTIONS

**Please read each of the following instructions carefully
before attempting questions**

There are EIGHT questions in all, out of which FIVE are to be attempted.

Question Nos. 1 and 5 are compulsory. Out of the remaining SIX questions, THREE are to be attempted selecting at least ONE question from each of the two Sections A and B.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.

All questions carry equal marks. The number of marks carried by a question/part is indicated against it.

Answers must be written in ENGLISH only.

Unless otherwise mentioned, symbols and notations have their usual standard meanings.

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

Neat sketches may be drawn, wherever required.

SECTION—A

1. (a) Discuss in brief 'wattling—an erosion control measure'. 8
- (b) Explain the different processes involved in the development of gullies. 8
- (c) Discuss the purpose, advantages and limitations of percolation tank. 8
- (d) Explain the process of 'restoration' and 'geometric correction' in digital image processing. 8
- (e) (i) What is false colour composite?
- (ii) Define atmospheric windows in relation to remote sensing. 8

2. (a) Discuss about the widely used *in situ* water conservation practices for non-arable land with their suitability and limitation. 10
- (b) Determine the peak rate of runoff for a 10-year frequency from a watershed of 250 hectares, having weighted value of runoff coefficient (C) as 0.47. The distance from the remotest point in the watershed to the outlet is 3000 m and the elevation difference between the highest and outlet points of the watershed is 25 m. The maximum intensity-duration-frequency relationship of the watershed is given by

$$i = \frac{6.311T^{0.1523}}{(D + 0.50)^{0.945}}$$

where i = intensity in cm/h, T = return period in years and D = duration of rainfall in hours. 10

- (c) Derive the expression for area lost in percentage for cultivation due to construction of bench terrace under the following conditions : 20
- (i) Batter slope 1 : 1
- (ii) Batter slope $\frac{1}{2}$: 1
3. (a) Explain the terms 'erodibility index' and 'roughness factor' used for prediction of wind erosion. 10
- (b) Design a grass waterway with trapezoidal cross-section for the following data :
- (i) Peak rate of runoff, $Q = 4.0 \text{ m}^3/\text{s}$
- (ii) Grade to be used = 0.3%
- (iii) Manning's roughness coefficient = 0.04
- (iv) Side slope, $Z = 2 : 1$ (H : V)

Assume other necessary data. 15

- (c) Determine the height of wing wall of a drop structure if the—
 (i) net drop from the top of transverse sill to the crest (F) = 2.50 m;
 (ii) head over the crest (h) = 1.50 m;
 (iii) height of transverse sill (S) = 0.50 m. 15
4. (a) What are the basic keys of image interpretation? Also enlist the sequences followed in the process of image interpretation. 10
 (b) How is classification done in digital image processing? 10
 (c) What do you understand by watershed prioritization? How can you prioritize the watershed for treatment from soil erosion and sediment yield point of view using remote sensing and GIS techniques? 20

SECTION—B

5. (a) Develop the relationship among delta, base period and duty of water. 8
 (b) Distinguish between reservoir storage efficiency and water storage efficiency. 8
 (c) What are the limitations in the adoptability of check basin method? 8
 (d) Design a bag storage structure for storing 300 tonnes of wheat with a stack of 10 bags in length, 10 bags in width and 10 bags in height. Each bag is of 100 cm × 60 cm × 30 cm dimension having capacity of 100 kg. Take a clear distance between the walls and the end of the stack as 0.8 m and between the stacks as 2.0 m. Give the complete floor plan of the structure with dimension and draw layout. 8
 (e) Classify various types of greenhouse and briefly discuss each of them. 8
6. (a) An area of 25 hectares is to be irrigated by a pump working for 10 hours a day. The available moisture-holding capacity of the soil is 16 cm/m and the depth of root zone is 1 m. Irrigation is to be done when 50 percent of the available moisture in the root zone is depleted. The water application efficiency is 75 percent. The peak rate of moisture used by the crops is 5 mm/day (weighted average). The losses in water conveyance are negligible. Determine the irrigation period, net depth of water application, depth of water pumped per application, and the required capacity of irrigation system in hectare-cm/day and litres per second. 20
 (b) What is cavitation? How does it affect the performance of pumping system? 10
 (c) Discuss in detail about the hydraulic design of open drains. 10

7. (a) How do air vents and end plugs protect the underground pipeline from damage? 10
- (b) What are the parameters to be considered in designing of tube wells? Explain. 10
- (c) (i) Compute the velocity of flow of water to be drained and discharge capacity of 150 mm diameter corrugated plastic pipe flowing full if the slope is 0.4 percent. Manning's roughness coefficient is 0.016. 10
- (ii) How will you reclaim and manage the saline soils? Explain. 10
8. (a) Discuss various factors to be taken care in designing a storage structure for grains. What measures can be adopted to improve the performance of traditional storage structure? 10
- (b) How are bricks (the common building material) prepared in India? Classify bricks and briefly discuss about each type of brick. 10
- (c) Discuss how you plan to construct a new dairy barn. Discuss various dairy barn equipments. Compare between stall barn and loose housing barn. 20

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