

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.

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.

Answers must be written in ENGLISH only.

Indian Forest Services (Main)
SECTION—A

1. (a) Discuss the major types of precipitation storm. 8
- (b) Discuss the impacts of soil erosion on water quality. 8
- (c) Discuss the basic assumptions and steps involved in the development of unit hydrograph. 8
- (d) Discuss the requirements and essential features of trickle spillway and flood spillway in an earth dam. 8
- (e) Explain the application of GIS in the area of water resource development and management. 8
2. (a) Explain the functional relationship of length of slope and degree of slope in the process of soil loss by water erosion. Discuss the methods of estimation of erosivity from rainfall data. 10
- (b) What are the factors that influence soil erodibility by wind? Discuss the impacts of different types of water erosion. 15
- (c) (i) A watershed has an area of 1000 hectares and an average slope of 1.5%. The average 30-year, 24-hour duration rainfall is 76.2 mm, while the runoff volume calculated by the curve number technique is 31.4 mm. The length to width ratio is 3.5 : 1. Determine time to peak and peak discharge.
- (ii) Determine the size of each side of a square box inlet for a drop spillway to handle a peak flow of 3.2 cumecs over a fall of 1.5 m, if the energy head to fall ratio is not to exceed 0.6 at any time. 10+5=15
3. (a) What are the principles and objectives of watershed management? Discuss the criteria used for prioritizing watersheds. 15
- (b) Discuss in brief about compartmental bunding, intra-plot water harvesting, ridge furrow planting and field bunding methods used for in situ water harvesting and moisture conservation. Enlist the ex situ methods of water harvesting. 10
- (c) Write down the principles to be adopted while calculating the spacing of bunds (contour and graded bunds). Also, calculate the height of the bunds, if the distance between the bunds is expressed by L , vertical interval between the bunds is expressed by V , width of water spread is expressed by W and land slope is expressed by S percent. Assume the maximum rainfall amount which has to stand behind the bund as 15 cm. 15

4. (a) Discuss the classification of remote sensing based on platform, energy source, regions of electromagnetic spectrum and number of bands. 15
- (b) Discuss the importance and requirement of ground truthing in remote sensing. Explain the various parameters of ground truthing used for remote sensing of land cover types. 15
- (c) Write short notes on the following :
- (i) Remote sensing data products
- (ii) Digital elevation models
- (iii) Types of cameras for aerial photography
- (iv) Forest cover mapping using remote sensing
- (v) Application of remote sensing for crop water stress monitoring 2×5=10

SECTION—B

5. (a) Discuss the important factors affecting planning and design of minor irrigation projects. 8
- (b) Discuss the subsurface vertical distribution of groundwater with an emphasis on different types of subsurface water. 8
- (c) Discuss the critical differences between crop water requirement and irrigation water requirement. 8
- (d) An agricultural area of 1 hectare needs to be drained of excess water. The soil contains 47% pore space and the soil moisture content after gravitational drainage is 39% (by volume). Find the void ratio, drainable porosity and drainable water volume from the area. The effective root zone depth of the area is 0.9 m. 8
- (e) With a neat drawing, explain the stanchion barn for housing of dairy animals. Mention its specific advantages. 8
6. (a) List the different methods of water flow measurement on an agricultural farm for an underground/overground pipeline and for open channel network. Also, briefly discuss their principles of measurement. 15
- (b) (i) Discuss the different types of drip irrigation systems based on installation method, emitter discharge rate and wetted soil surface area. 7
- (ii) A sprinkler irrigation system is to be installed in an area of 20 hectares. The crop to be irrigated is wheat with gross application depth of 20 cm. The irrigation interval is 10 days with 12 operating hours per day. Determine the sprinkler irrigation system flow capacity in litres per second. 8

(c) Write short notes on the following :

- (i) Warabandi system of water allocation
- (ii) Conjunctive use of surface and groundwater
- (iii) Soil moisture characteristic curve
- (iv) Fertigation equipment
- (v) Reference evapotranspiration

2×5=10

7. (a) Discuss the advantages and limitations of surface drain and subsurface drain. Explain and discuss the information required to design and for the installation of subsurface drainage systems. 15
- (b) Discuss the characteristics of saline, sodic and saline-sodic soils. Explain the principles and approaches of saline soil management. 15
- (c) What are the requirements of good water supply distribution system for farmstead? Briefly discuss about the different water distribution systems commonly adopted in farmstead. 10

8. (a) Write short notes on the following :

- (i) Electric farm fencing
- (ii) PUSA storage bin
- (iii) Advantages of greenhouse cultivation
- (iv) Requirements of good storage structures
- (v) Classification of lime used in farm housing

3×5=15

- (b) (i) Write briefly about the various aspects of selection and design of greenhouse. 10
- (ii) Briefly describe the different types of silos which can be used to store animal feed/forage. 5
- (c) What are the advantages of deep litter poultry housing? Draw a neat sketch to accommodate 1000 birds. Take floor area of 0.36 sq. m per bird. 10
