

I.F.S. EXAM-2016

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. Answer each of the following :

- (a) What are the main causes of soil erosion in India? Explain the agronomic practices adopted for controlling the soil erosion. 10
- (b) What are the contour and graded bunds? How do they differ in design and functional aspects? 10
- (c) Let $P_1, P_2, P_3, \dots, P_n$ be the depths of rainfall recorded in n rain gauges enclosed by polygon having areas $A_1, A_2, A_3, \dots, A_n$ within the watershed. Calculate the average depth of rainfall (P) in the watershed of area A . 10
- (d) Calculate the cross-section of a contour bund used to store 24-hour excess rainfall of 10 cm. The annual rainfall is about 120 cm with a high intake rate and there is low coverage of crops over the land. The land slope is 4%. Use Cox's formula for VI of contour bund. 10

2. (a) With a neat sketch, explain the working of drop inlet spillway. Under what situation is it preferred? 10
- (b) What are the main objectives of watershed management programme? What survey is required to be conducted while planning for watershed development? 10
- (c) Design the dimensions of a weir used to discharge excess runoff through a contour bund for the conditions given below :

Land slope = 1.5%

Top width of the bund = 45 cm

Height of the bund = 60 cm

Height of crest above GL = 30 cm

Side slope of the bund = 2:1

VI = 1 m

Length of the bund = 400 m

Intensity of rainfall for the return period and time of concentration
= 12 cm/hr

During the peak rainfall constant infiltration rate = 2.5 cm/hr

No water is stored behind the bund before the peak rainfall occurs

Determine the volume of water stored behind the bund before it starts flowing. 20

3. (a) Describe in brief the runoff inducing practices for increasing runoff for water harvesting. 10
- (b) Define rational formula for estimating peak runoff rate. Why is it called rational? What are the limitations of rational formula? 10
- (c) Design a 150 m long inward sloping (5%) bench terrace for a sandy loam soil with an average slope of 15%. The entire width of the terrace acts as a channel which is provided with a uniform grade of 0.6%. The rainfall intensity for the return period and time of concentration is 20 cm/hr, runoff coefficient = 0.3, riser side slope = 1:1, shoulder bund height = 30 cm, bottom width = 75 cm, side slope = 1:1, Manning's $n = 0.04$, $VI = 1.06$ m, area of the terrace = 0.09 ha. 20
4. (a) Classify remote sensing based on type of data acquisition. Explain in brief the application of remote sensing in agriculture and forestry. 10
- (b) What is water-stage recorder? Discuss the current meter as a water flow measuring device. 10
- (c) Design a parabolic shaped grassed waterway to carry a flow of 3 cu m/s down a slope of 4%. An excellent stand of dub grass is to be maintained in the waterway. Take Manning's $n = 0.04$. 20

SECTION—B

5. Answer each of the following :

- (a) Define a weir. Draw the neat sketch of a rectangular weir placed in a channel and label it. 10
- (b) Write short notes on the following irrigation efficiencies : 10
- (i) Water conveyance efficiency
 - (ii) Water application efficiency
 - (iii) Water storage efficiency
 - (iv) Water distribution efficiency
- (c) Define a centrifugal pump. Discuss the probable reasons when the centrifugal pump may fail to operate. 10
- (d) An engine-driven centrifugal pump is to be installed in an open well. The yield of the well is sufficient to deliver 16000 litres of water per hour. The static water level is 15 m and the pumping water level is 18 m from ground level. Total losses due to friction in pipe and accessories may be assumed 15% of the total static head. If the pump efficiency is 55% and drive efficiency is 70%, calculate the BHP of the engine required to drive the pump. 10

6. (a) Write in brief on the following : 10
- (i) Venturi meter
 - (ii) Parshall flume
 - (iii) Cipolletti weir
 - (iv) Tensiometer
- (b) Discuss the major components of a drip irrigation system with necessary drawing. 10
- (c) Tomato with 60 cm effective root zone depth is grown in a soil with field capacity and permanent wilting point of 22% and 8% respectively. Irrigation is applied after 40% depletion of the available moisture. Apparent specific gravity of soil = 1.6. Calculate the depth of irrigation required. If a pump delivers 10 l/s discharge, how much time will it take for the irrigation of 2 ha? Assume no loss of water. 20
7. (a) Define agricultural drainage. What are the sources and ill effects of drainage? 10
- (b) Runoff water from a watershed enters into a drainage area for 8 hours at the rate of $3 \text{ m}^3/\text{s}$. The total rainfall during 24-hour period is 12 cm and the total infiltration during the period is 4 cm. If the total drainage area is 200 ha and the crop can tolerate a ponding of 10 cm, calculate the drainage coefficient of the land. 20
- (c) Discuss the following in brief : 10
- (i) Mole drain
 - (ii) Interceptor drain
 - (iii) Bio-drainage
 - (iv) Channel lining
8. (a) What is polyhouse? Describe the working of fan and pad cooling system with a neat sketch. 12
- (b) Classify silos. Describe constructional features and use of pit silos. 12
- (c) A rectangular farm of 10 ha (500 m $\times$ 200 m) is to be fenced by barbed wires with concrete poles. Estimate the cost of fencing with six rows of barbed wires. Assume suitable values for spacing of posts and appropriate prices for posts and wires. 16
