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भारतीय वन सेवा परीक्षा 2011

Indian Forest Services Examination

D-VSF-L-NRA

AGRICULTURAL ENGINEERING

Paper I

Time Allowed : Three Hours | *Maximum Marks : 200*

INSTRUCTIONS

Candidates should attempt Questions No. 1 and 5 which are compulsory, and any THREE of the remaining questions, selecting at least ONE question from each Section.

All questions carry equal marks.

Marks allotted to parts of a question are indicated against each.

Answers must be written in ENGLISH only.

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

Neat sketches may be drawn, wherever required.

SECTION A

1. Answer any *four* of the following, not exceeding 150 words for each :

   (a) Explain factors affecting erosion by water. *10*

   (b) Describe characteristics of the contour lines. Explain the procedure to conduct topographical survey of a watershed by direct contour method. *10*

(c) Establish a relationship for width of bench terrace in terms of land slope, vertical interval and the riser inclination. *10*

(d) Discuss the mechanics of wind erosion. *10*

(e) Write plotting position method of frequency analysis and its use in soil and water conservation engineering. *10*

2. (a) What is watershed ? Write major objectives of watershed management programmes. What available information would you like to collect before conducting field survey in a watershed for preparation of watershed plan ? *10*

(b) Describe with the help of suitable diagrams three types of earth embankments. *10*

(c) Describe with proper illustrations different types of drainage systems used in earth embankments. *10*

(d) Discuss different phases of design procedure of permanent soil conservation structures. *10*

3. (a) What are the reasons for inconsistency in rainfall record ? Explain the method of removing inconsistency in rainfall data. *10*

(b) Explain the different methods of determining the average rainfall over a watershed due to a storm. Discuss the relative merits and demerits of the various methods. *10*

(c) Define flood routing. Also describe the elements of flood routing. *10*

(d) Design a parabolic shaped grassed waterway to carry a flow of 2·0 m^3/sec down a slope of 4·0%. The maximum velocity of flow is 1·5 m/sec and a freeboard of 10 cm is recommended. Assume n = 0·04. *10*

4. (a) Write the procedure to determine the priority watersheds. *10*

(b) List elements used in object recognition in photo interpretations. *10*

(c) Enlist the techniques of air photo interpretation. *10*

(d) Discuss merits and demerits of conventional and remote sensing approach in watershed survey for its development. *10*

SECTION B

5. Answer any ***four*** of the following, not exceeding 150 words for each :

(a) Discuss briefly about water conveyance, water application, water storage, water distribution and water use efficiency. *10*

(b) Define drainage coefficient. Describe different types of land requiring drainage. *10*

(c) What are main types of canal linings ? List advantages of having lining of irrigation canals. *10*

(d) Discuss different points to be considered for selection of site of farmstead. *10*

(e) Explain the stream flow measurement by area-velocity method. *10*

6. (a) What is consumptive use ? Explain different methods of consumptive use measurement. *10*

(b) What do you understand by aeration of a weir ? Explain. Discuss standard conditions that must be observed for installing a weir. *10*

(c) An undisturbed soil sample was taken with core sampler from a field 36 hrs after irrigation when the moisture was at field capacity. The core sampler was 7·5 cm in diameter and 15 cm deep. The weight of the sampler with moist soil was 2·52 kg and weight of oven dry soil was 2·34 kg. The weight of core sampler was 1·34 kg. What is the available moisture holding capacity ? *10*

(d) A tube-well is constructed in a confined aquifer. The discharge of the tube-well is 28 lit/sec. The thickness of the aquifer is 12·0 m and drawdown is 20·0 m. The coefficient of permeability of the aquifer material is 12 m/day and the radius of influence is 190 m. Calculate diameter of the well.. *10*

7. (a) The following data were obtained in determining the soil moisture content at successive depths in the root zone prior to applying irrigation water :

Depth of sampling, cm	Wt. of moist soil sample, gm	Oven dry weight of soil sample, gm
0 – 25	135	127
25 – 50	137	128
50 – 75	123	115
75 – 100	111	102

The bulk density of the soil in the root zone was 1·50 gm/cm^3. The available moisture holding capacity of soil was 17·8 cm/m depth. Determine

(i) The moisture content at the different depths in the root zone.

(ii) Moisture content in the root zone at the time of irrigation.

(iii) Net depth of water to be applied to bring moisture content to field capacity.

(iv) Gross irrigation requirement at estimated field irrigation efficiency of 70 percent. *10*

(b) How will you design a sprinkler irrigation system for a farm ? Explain. *10*

(c) Describe principal characteristics of a centrifugal pump. *10*

(d) Differentiate between : *10*

(i) Water requirement and Irrigation requirement

(ii) Crop water use efficiency and Field water use efficiency

(iii) Evaporation and Consumptive use

(iv) Confined and Unconfined aquifer

(v) Infiltration and Percolation

8. (a) A pump directly driven with motor discharges water at the rate of 600 lit per minute. Water horsepower is 7. Pump efficiency is 60%. Frictional losses in the system are 12% of static head and the velocity head is 3% of static head. Motor efficiency is 80%. Determine : *10*

(i) Static head

(ii) Input horsepower to motor

(iii) Kilowatt input to motor

(b) How can you distinguish between sands with or without organic matter ? Explain. *10*

(c) What is slump test on concrete ? What is its significance in building construction ? *10*

(d) Write causes for development of salinity and alkalinity in the soils. *10*