

2011
AGRICULTURAL ENGINEERING (Optional)
(Paper – II)

580045

Standard : Degree

Total Marks : 200

Nature : Conventional (Essay) type

Duration : Three Hours

N. B :

- 1) Answers must be written in English.
- 2) Question No. 1 is **compulsory**. Of the remaining questions, attempt **any four** selecting one question from **each Section**.
- 3) Figures to the **RIGHT** indicate marks of the respective question.
- 4) Use of log table, Non-programmable calculator is permitted, but any other Table/ Code/ Reference book are not permitted.
- 5) Make suitable assumptions, wherever be necessary and state the same.
- 6) Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.
- 7) Credit will be given for orderly, concise and effective writing.
- 8) Candidates should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.

Marks

Answer **any four** of the following (10 marks each) :

(40 marks)

1. (a) Draw neat sketch of Parshall flume (plan and elevation) and label its different components. Discuss, how discharge is measured using this flume, with free flow and submergence conditions in the flume. 10
- (b) Explain, stepwise, the design of gravel pack size and screen slot size for gravel packed tube wells. 10
- (c) In a watershed, four rain gauges I, II, III and IV are installed. The depths of normal annual rainfall recorded at these stations are 80.0, 65.0, 75.5 and 92.0 cm respectively. The rain gauge at station I went out of order during one of the years. The annual precipitation for that year recorded at the other three stations is 90.0, 72.5 and 80.0 cm at II, III and IV stations respectively. Estimate the rainfall at station – I in that year. 10

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- (d) Derive $h = \left(\frac{R_e VI}{50} \right)^{1/2}$ in a contour bund 10

where, h = height of water in the u/s, cm

340082 R_e = 24 hr rainfall excess, m

VI = vertical interval, m

HI = horizontal interval, m

S = slope, %.

- (e) Discuss, with sketch, about electrical resistance method to measure soil moisture. Write about functions of different components of this device and also discuss merit/demerit of this method. 10

SECTION - A

2. (a) Define different types of soil waters and classify on the basis of surface tension. Discuss characteristics of different kinds of soil waters in detail. 10
- (b) Determine the water distribution efficiency in a 150 m long straight furrow, when the soil sampling after an irrigation in 25 m interval in the furrow showed that the effective depth of water penetration in 60 cm root zone were, 56, 54, 52, 50, 49 and 49 cm. 10
- (c) What do you understand by drainage porosity? How this can be estimated in agricultural field? 10
- (d) Write requirements of agriculture drainage for crop production and discuss in brief, about merit/demerit of different methods used for field drainage. 10
3. (a) What do you understand by cumulative infiltration and basic infiltration? Give the relationships between cumulative infiltration and time elapsed and also discuss factors influencing the infiltration rate in soils. 10
- (b) A check basin of size 12 m × 12 m is to be irrigated from a stream of 7 lit/sec. Followings are the observations about the field : 10
- | | |
|---|-------|
| (i) Water holding capacity of the soil | 14% |
| (ii) The average soil moisture in the root zone before the irrigation | 6% |
| (iii) The average depth of crop root zone | 1.1 m |
| (iv) Apparent specific gravity of root zone soil | 1.5 |
- Estimate required duration of irrigation to be applied to the basin to replenish the root zone moisture to its field capacity, assuming no loss due to deep percolation.
- (c) Establish relationship for hydraulic conductivity measurement using single augur hole method in shallow water table condition. Draw neat sketch showing all parameters used and write all assumptions. 10
- (d) (i) Define leaching requirements and establish relationship for depth of irrigation water with electrical conductivity of irrigation and drainage water.
- (ii) Determine the depth of irrigation water which would change 25 cm depth of soil into saline condition, if the E C of irrigation water is 1 milli mhos/cm. The bulk density of the soil is 1.2 gm/cubic cm and saturation percentage of soil is 40. 10

SECTION – B

4. (a) A well penetrates 35 m into a saturated unconfined aquifer. The discharge of well was 10 lit/sec at 7m drawdown in pumping well. Assuming equilibrium condition and aquifer as homogeneous isotropic, estimate the discharge at 12 m drawdown. 15
- (b) Design an irrigation channel to be constructed in alluvial soil with side slope $\frac{1}{2} : 1$ (H : V) by using Lacey's regime theory, for carrying a discharge of 40 m³/sec Lacey's silt factor may be taken as 0.8. 15
- (c) What do you understand by Duty, Delta and Base period in canal irrigation system ? Discuss various factors affecting the duty in detail. 10
5. (a) Describe Cooper-Jacob (modified Theis) for the estimation of aquifer coefficients in fully penetrating confined well. Draw neat sketch and write assumptions. 15
- (b) Estimate the carrying capacity of pre-fabricated channel section of following specifications. Take Manning's n for pre-fabricated channel as 0.015. 15
- Top width = 20 cm
Bottom width = 17.5 cm
Bottom slope = 0.20%
Height = 17.5 cm
- (c) Discuss cross drainage work in canal system. Describe it, using neat sketches. 10

SECTION – C

6. (a) (i) Describe two classifications of traversing in surveying. 5
- (ii) Explain any five factors affecting the permeability of soils. 10
- (b) Calculate the runoff from a watershed of 60 ha. The following observations are available : 10
- Depth of rainfall : 100 mm
Antecedent rainfall condition : AMC I
Row crop, good condition : 40 ha
Wood land, good condition : 20 ha
- The day after the rainfall of 100 mm, another rainfall of 50 mm occurred (AMC III). Calculate the surface runoff from the watershed using curve number method for two rainfalls :

Type of crop	Curve Number at AMC II	Conversion factor from AMC II to AMC I	Conversion factor from AMC II to AMC III
Row crop, good	82	0.80	1.13
Woodland, good	55	0.65	1.35

Assume initial abstraction, $I_a = 0.2 S_m$

where, S_m = Reservoir capacity

Prove that antecedent moisture content (AMC) plays an important role in generation of runoff rather than the amount of rainfall.

- (c) Explain three types of permanent gully control structures. 15

7. (a) (i) Explain the collimation system of reduction of levels. 5
 (ii) Explain any five factors affecting the soil compaction. 10
 (b) A catchment of 5 KM² is having an average sloping of 0.006 and the maximum traveling distance of rainwater in the catchment is 1.95 KM. The maximum depth of rainfall in the area with a return period of 25 years is as given below

Time duration (min.)	5	10	15	20	25	30	40	60
Rainfall depth (mm)	15	25	32	45	50	53	60	65

10

Assume the following data for coefficient of runoff (C) :

Catchment sandy loam soil : 2 KM², C = 0.2

Catchment light clay soil : 3 KM², C = 0.7

Compute the peak rate of runoff by rational method. Use Kirpich's equation for computing the time of concentration, T_c.

- (c) Describe any three types of temporary gully control structures. 15

SECTION - D

- (a) Explain the importance of the three different types of Bench Terraces in soil and water conservation functions. 10
 (b) Write about the role of various types of plastic lining materials in the farm pond construction. 10
 (c) Explain the role of Watershed Association (WA), Watershed Committee (WC) and Self Help Group (SHG) in the watershed development. 10
 (d) Explain about the GIS application in land, water and forest resources management. 10
9. (a) Describe the entire procedure of design of vegetated waterways and its main functions in disposal of excess runoff from the watershed. 10
 (b) Explain three types of farm pond and their main functions of storing water for irrigation and other purposes. 10
 (c) Describe the evaluation procedure of soil and water conservation work in a watershed. 10
 (d) Write on Indian Remote Sensing Satellites and Sensors. 10

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