B.Tech Even Semester (CBCS) Exam., April—2017

AGRICULTURAL ENGINEERING

(8th Semester)

Course No. : AE–804 (C)

(Watershed Planning and Management)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

Note : 1. Attempt **one** question from each Unit.

2. Begin each answer in a new page.

3. Answer parts of a question at a place.

4. Assume reasonable data wherever required.

5. The figures in the margin indicate full marks for the questions.

UNIT—1

1. *(a)* Determine the values of coefficients to derive the relationship between lengths of streams and their contributing area (L = aA^b), using the following data : 9

Stream order	1	2	3	4	5
Area (ha)	15	35	45	70	165
Length of stream (m)	400	600	675	850	1300

(2)

(b) Expatiate the role of watershed management in developing solutions to natural resource problems. 6

2. *(a)* Details of a drainage basin are as follows :

Total length of stream
segment = 4000 m
Area of drainage basin = 5 km^2
Total number of stream
segments = 55
Relief = 50 m

Find—

(i) drainage density;

(ii) length of overland flow;

(iii) constant of channel maintenance;

(iv) stream frequency;

(v) ruggedness number;

(vi) slope of ground surface. 6

(b) Define the following : 1×4=4

(i) Elongation ratio

(ii) Circulatory ratio

(iii) Form factor

(iv) Law of stream areas

(c) Determine the slope ratio of drainage basin for the following values of slope of various orders of stream segments : 5

Stream order	1	2	3	4	5
Average slope (°)	5	7.5	12	15	20

UNIT—2

3. (a) What are Puerto Rico Terrace and Stone- Wall Terrace? Describe with sketches. 7

(b) Determine the cross-section of contour bund, which is to be constructed on land slope of 3%, to store the rainwater of 24 hours excess rainfall as 15 cm. The annual rainfall of the area is recorded as 97·5 cm. The soil is under good vegetative cover. Given, rainfall factor = 0·4, infiltration and crop cover factor = 2. 8

4. (a) What do you mean by Gradioines and Box Cum Pit soil and water conservation measures? 7

(b) A 350 m long graded bund has been proposed to construct on a land of 3% slope. The type of soil is sandy. The rainfall intensity of the area was recorded as 18 cm/h for the duration

equal to the time of concentration. The grades to be maintained are as follows : 8

1st 50 m length = 0·1%, 2nd 150 m = 0·15%, 3rd 150 m = 0·2%

Assume vertical interval as 1·25 m and runoff coefficient C as 0·35.

Using the above data, determine the dimension of bund.

UNIT—3

5. (a) With labelled schematic diagrams, formulate the total height for main dyke, secondary dyke and tertiary dyke. 10

(b) Write a short note on wave rush. 5

6. (a) Design an earthen embankment with the following data : 9

Catchment area = 20·2 ha;
Intensity of rainfall = 17·5 cm/hr;
RL of natural surface = 100;
RL of HFL = 103·00;
Runoff coefficient = 0·30;
Soil-type sandy loam.

(b) Write short notes on (i) runoff inducement and (ii) capacity of the pond. 3+3=6

(5)

UNIT—4

7. *(a)* A watershed of 1000 hectare is equipped with a rectangular weir at its outlet point. The length of weir crest is 1·5 m. Calculate the amount of bed load and total sediment load, using the following information on suspended load : 7

Coarse sediment = 4 g/l
Medium sediment = 6·5 g/l
Fine sediment = 1·5 g/l

Given—

Density of sediment = 1·4 g/cc

(b) Describe the two methods of determination of a i.e. gauge reading corresponding to zero discharge. 8

8. *(a)* The stage (h) vs discharge (Q) data of a river are given. Establish the rating curve by taking stage value at zero discharge as $a = 20·5$ m. Determine stage corresponding to $Q = 2600$ m^3/s. 10

h (m)	21·95	22·45	22·80	23	23·4	23·75	23·90
Q (m^3/s)	100	200	295	400	490	500	640
h (m)	24·05	24·55	24·85	25·40	25·45	25·55	25·90
Q (m^3/s)	780	1010	1220	1300	1420	1550	1760

(b) Write a short note on silt observation point. 5

(6)

UNIT—5

9. *(a)* Explain the economic and financial evaluations of a watershed project. 4

(b) Give a comparative analysis of vegetative and mechanical measures of watershed protection work. 5

(c) Explain the method of estimation of benefit cost ratio of watershed development projects. 6

10. Formulate the layout of a project proposal for watershed management work. 15

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