THE OPEN UNIVERSITY OF SRI LANKA
Diploma in Technology (Civil) – Level 4

047

CEX 4233 – Irrigation Engineering
Final Examination - 2009

Date : 29th March 2009
Time : 9:30 – 12:30 hrs
Duration : Three (03) hours

Answer any five (05) questions. All questions carry equal marks.

1.

The Maduru Oya project, located in the basin of Maduru Oya, was the first major project taken up for construction by the accelerated Mahaweli Development Scheme. The Maduruoya project envisages the construction of a 40 m high and 1080 m long rockfill dam across Maduru Oya to create a reservoir of capacity 467 MCM.

a. You are requested to select the best type of dam for a particular site. What are the considerations that you will make in achieving the above? (3 marks)
b. Considering the answer given for part (a), discuss the reasons behind selecting a rock fill dam for the Maduruoya project . (5 marks)
c. The Maduru Oya project attracted a great deal of attention, worldwide, after discovering the remains of a massive earth dam constructed centuries ago, at the very site chosen for the new dam. Taking examples from the hydraulic structures that have survived to this day, discuss about the high achievements in irrigation management and technology of our ancient engineers. (5 marks)
e. Discuss the methods adopted to control seepage through and underneath earth – rock dams. (4 marks)
f. An environmental assessment prepared by USAID in 1980 predicted many of the major adverse environmental changes that would result from the accelerated Mahaweli Development Project. Discuss about three (3) major environmental changes due to the accelerated Mahaweli Development Project. (3 marks)

2.

a. Explain what is meant by stream gauging. Briefly describe the velocity area method that is used for stream gauging. (5 marks)
b. The following measurement data (Table Q2) were observed in a stream with a standard current meter test. (15 marks)

Table (2)

Distance from right bank (m)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
Depth (m)	0	0.4	1.3	2.2	2.6	2.3	1.7	1.4	1.25	0.75	0.45	0
Velocity (m/sec) at 0.2d	0	0.41	0.56	0.75	0.86	0.81	0.75	0.63	0.59	0.54	0.45	0
Velocity (m/sec) at 0.8d	0	0.20	0.36	0.55	0.61	0.30	0.51	0.42	0.39	0.33	0.25	0

Calculate the discharge of the stream.

3.

a. List the topographical surveys that are necessary when drawing plans to build a reservoir. (5 marks)

b. A reservoir bed survey is a must in selecting a suitable location for a dam site. Briefly explain why and how it is done. (5 marks)

c. The capacity - elevation data of a proposed reservoir is given in table (3). (10 marks)

Table (3)

Elevation (m)	Area (ha)	Cost of construction (Million Rupees)	Present value of income (Million Rupees)
100	0	0.5	-
110	140	4	5
120	320	5	6.2
130	615	6	8.4
140	960	7	8.5
150	1325	8	8.6

i. Calculate the reservoir capacity at various dam elevations

ii. Find the most economical height of the dam.

4.

a. Water is conveyed to an irrigation scheme from a river or a reservoir by means of canals. Briefly describe about the different types of canals and specific situations of their preference. (5 marks)

b. For the continuous and efficient functioning of irrigation canals proper maintenance is inevitable. List the various problems that are posed by the canals during their use and discuss about the remedial measures. (5 marks)

c. An area of 40,000 hectares has to be irrigated by a canal, for which the water requirement is 10 cm per month. The following data is given.

Mean slope of the ground = 1 in 3400

Manning's roughness coefficient = 0.025

Side slopes = 1 : 1

i. Calculate the discharge in the canal (5 marks)

ii. Design a suitable canal section (Try a depth of 2 m) (5 marks)

5.

a. The cropping pattern indicates the sequence in which the crops are to be grown during the year. Explain why a cropping pattern is prepared. (3 marks)

b. Define the duty of a crop. Illustrate the relationship between duty and delta. (3 marks)

c. What are the possible courses of water losses in canals? Briefly discuss about the measures that should be adopted to reduce such losses. (3 marks)

d. The transplantation of paddy takes 16 days and the total depth of water required by the crop is 60 cm on the field. During the transplantation period, there is about 10 cm of useful rain.

Find the following;

i. The duty of irrigation water required for paddy during transplantation period. (6 marks)

ii. the duty of water at the head of the water course and at the head of distributory. (5 marks)

(Assume 25% loss of water in water courses and 15% loss from the distributory head to the water course head.)

6.

a. Compute the depth and frequency of irrigation required for a certain crop using the data given below; (8 marks)

Field capacity of soil = 28%

Permanent wilting point = 13%

Density of soil = 1.3 g/cm3

Effective depth of root zone = 70 cm

Daily consumptive use of water for a given crop = 12 mm

b.

i. In what manner does seepage endanger the safety of a structure on permeable foundation? How will you ensure the safety of structures against seepage effects? (6 marks)

ii. Samanalawewa reservoir is presently operating with a continuous leakage of 1800 litres per second. Discuss about the possible causes that would have led to the leakage of Samanalawewa reservoir. (6 marks)

Provide answers to any three of the following; (20 marks)

a. The foundation on which the dam is built is vital to its stability over a long period of time. Discuss about the suitable foundations for a dam site.

b. A special feature of our ancient irrigation system was the conveyance of water from one river basin to another by means of artificial canal systems. Giving examples discuss about the efficient distributory system we had in ancient Sri Lanka.

c. 'Out of the different types of dams, there is none more permanent than the solid concrete gravity dam'. Discuss the above statement.

d. A pricing system for irrigation water is virtually non-existent in Sri Lanka. Discuss the advantages and disadvantages of such a system if adopted in Sri Lanka.

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