THE OPEN UNIVERSITY OF SRI LANKA
Diploma in Technology (Civil) – Level 4
CEX 4233 – Irrigation Engineering
Final Examination – 2013/2014

Date : 6th September 2014
Time : 13:30 – 16:30 hrs
Duration : Three (03) hours

Answer any five (5) questions. All questions carry equal marks.

1.

a. Briefly explain the affect of the following factors on the duty of a crop.
   i) Soil and sub-soil condition
   ii) Stage of growth
   iii) Temperature
   iv) Rainfall

b. Compute the depth and frequency of irrigation required for a certain crop, with data given below;

Depth of root zone	= 100 cm
Field capacity	= 22%
Wilting point	= 12%
Specific gravity of soil	= 1.50
Consumptive use	= 25 mm/day
Efficiency of irrigation	= 50%

Assume 50% depletion on available moisture before application of irrigation water at field capacity.

2.

a. Earth dams have been the most common in Sri Lanka since the ancient ages. State why it is preferred to other types and draw a cross sectional view of an earth dam, identifying important components.

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b. One of the first steps in the design of an earth dam is to determine the forces acting on the body of the dam. Explain the main forces that act on an earth dam?

c. Rip rap is a layer of large and durable rock fragments placed on the upstream slope of an earth dam. Explain why Rip rap is placed on the upstream slope of the dam?

d. Earth dams are less rigid and hence, more susceptible to failure. Discuss about the possible causes that will lead to the failure of earth dams (Explain with diagrams whenever possible).

3.

a. Irrigation channels require lot of maintenance and upkeep as to ensure their continuous efficient functioning.

   i) Briefly explain about three (3) problems that can reduce the efficiency of an irrigation channel.

   ii) Explain one remedial measure for each problem that you have identified in (i).

b. (i) An existing unlined channel has the following dimensions:

Width of the bottom	= 1.52 m
Side slopes	= 1 vertical to 1.5 horizontal
Depth of flow	= 0.91 m
Bed slope	= 0.0006

(assume Manning's coefficient = 0.025)

Determine the velocity of flow and check whether it lies in the non - silting, non - scouring range. Also determine the discharge in the channel.

(ii) It is proposed to line the above channel for the same discharging capacity. Find out the dimensions and perimeter of the lined channel if the following data are given;

Free - board	= 0.15 m
Manning' coefficient	= 0.014

4.

a. The successful design of an irrigation scheme depends on the availability of relevant data. Discuss the different types of data required for designing an irrigation scheme.

b. Several types of hydraulic structures and installations are used in measuring discharges in open channels or rivers. List four (4) of the above types and discuss briefly the purpose of measurement of discharge.

c. Compute the stream flow for the measurement data (obtained from current meter observations) given below (Table Q4):

Distance (m)	0	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6
Depth (m)	0	0.3	1.29	2.16	2.55	2.22	1.68	1.41	1.05	0.63	0.42	0
Velocity (m/sec) at 0.2d	0	0.42	0.57	0.78	0.87	0.81	0.75	0.69	0.63	0.54	0.45	0
Velocity (m/sec) at 0.8d	0	0.21	0.36	0.54	0.60	0.30	0.51	0.45	0.39	0.33	0.30	0

Table Q4.

Hint: While analyzing standard current meter observations, the river cross section is divided into segments as shown in Fig. Q4.

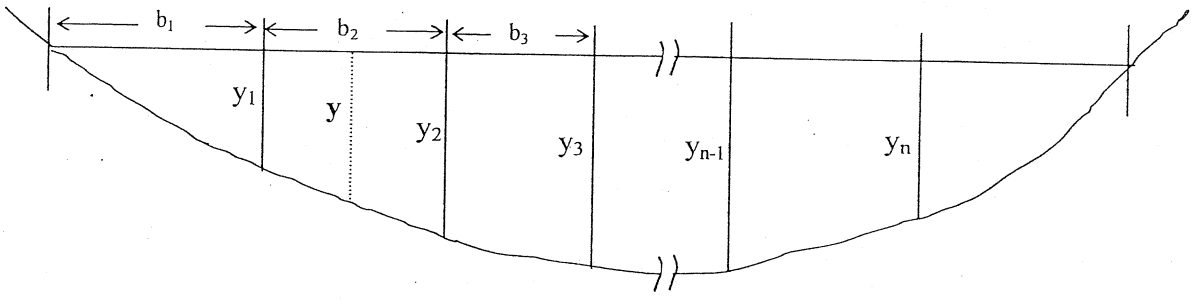

Fig. Q4. River section divided into n segments

5. (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?

(b) About 40% of the dam failures in the world have been due to foundation failure. In what aspects should you investigate for a good design of the foundation of dams and reservoirs?

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

(d) Victoria dam is a double curvature arch dam constructed in Sri Lanka. Discuss why the above is selected for the location.

6.

a. 'A spillway constructed at a dam site is essentially a safety valve for the dam' Discuss critically the above statement.

b. Enumerate the various types of spillways and describe in detail the most widely used type in Sri Lanka.

c. Explain the use of a mass curve in the design of a reservoir.

7.

a. Diversion structures in the form of weirs and barrages across natural rivers are used to head up water so that the water can be diverted through a different course or canal. Explain the functions of the above structures with examples. Discuss about the weirs and barrages in Sri Lanka.

b. What are the important considerations that must be made in selecting a suitable site for a weir.

c. Briefly discuss about the main causes of failure of weirs on permeable foundations. What remedies would you suggest in preventing them?

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