THE OPEN UNIVERSITY OF SRI LANKA

Diploma in Technology (Civil) – Level 4

CEX 4233 – Irrigation Engineering

Final Examination - 2007

048

Date   : 24th March 2007
Time   : 13:30 – 16:30 hrs
Duration   : Three (03) hours

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

1.

As in other developing countries the World Bank's recipe for Sri Lanka is to guide the country towards water privatization as part of the economic reforms. The proposed Water Services Reform Act, presented in October 2003, will allow the government to "hand over control of primary water sources like rivers and reservoirs to water supply companies who then decide whom they should charge and what price." The concept of charging for water is a foreign concept to the people of Sri Lanka.

a. Discuss critically, the concept of 'water privatization in Sri Lanka'.

b. If you are given to decide a price for water, draw up a plan that will enable you to decide whom and how much to charge.

c. Ancient irrigation systems were constructed to provide free access of water to humans and animals. Discuss on the ancient water management procedures.

d. Suggest methods that can be used instead of 'water privatization' for efficient water management.

2.

Pogolla barrage – a diversion structure across Mahaweli Ganga was used to head up water, so that the water can be diverted through a different course or canal. In early 1970s irrigation was given priority under the above project, but now the policy is to make optimal use for hydropower generation.

a. Explain the functions of structures such as Polgolla barrage and critically discuss the above change in water usage policy.

b. Distinguish between a storage dam and a diversion dam. Giving examples discuss about the above structures in Sri Lanka.

c. The choice of a particular dam is generally governed by several factors. Explain the factors that will help you to assess which dam is best suited for different site conditions. Include at least two examples from major irrigation schemes in Sri Lanka.

d. What are the main causes of failure of weirs on permeable foundations and what are the remedies you would suggest in preventing them?

3.

a. Benefits derived from canal lining are so great the disadvantages can be overlooked. Explain the benefits derived by lining canals.

b. Discuss some of the disadvantages involved in lining canals.

c. Briefly explain the types of lining including materials that are commonly used for lining.

d. Explain how you would select the best type of lining for a canal.

e. Design a concrete lined channel to carry a discharge of 350 cumecs at a slope of 1 in 5000. The side slopes of the channel may be taken as 1.5:1. The value of n for the lining is 0.014. Assume limiting velocity in the channel as 2 m/sec. Assume a suitable section for the channel.

4.

a. Enumerate the different methods that are used for measuring discharges in open channels or rivers. Explain anyone of the above methods in detail.

b. You have been asked to measure the discharge of

     i. a river

     ii. a small stream

     iii. a canal.

Describe briefly how you would carryout the measurement in each case.

c. The following data was obtained for a stream of 4 m width (see Figure Q4, AE=-4m) with a current meter.

Depths at A, B, C, D and E are 0, 2, 4, 2 and 0 m respectively.

Velocities at mid depth of B, C, and D are 0.6, 0.8 and 0.6 m/s respectively.

Assume velocities at A and E are zero and distance AB=BC=CD=DE
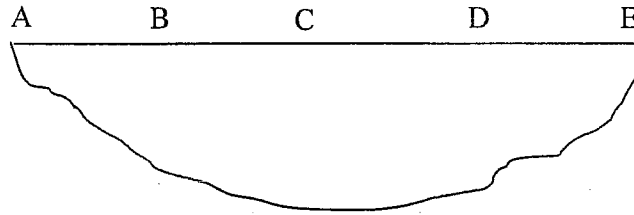Calculate the discharge of the stream.

A   B   C   D   E

Fig. Q4. Stream section

5.

a. Lands are said to be arable if they can be prepared for agriculture and if they can give a sufficient yield to justify its development. What are the specific factors that should be considered before selecting a suitable land for agriculture?

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

c. The following data pertains to healthy growth of a crop.

i)	Field capacity of soil	=	30%
ii)	Permanent wilting percentage	=	11%
iii)	Density of soil	=	1300 kg/m3
iv)	Effective depth of root zone	=	700 mm
v)	Daily consumptive use of water for the given crop	=	12 mm

For healthy growth, moisture content must not fall below 25% of the water holding capacity between the field capacity and the permanent wilting point. Determine the watering interval in days indicating the assumptions you make.

6.

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

b. Briefly explain about the other types of topographical surveys that are necessary for drawing plans for a reservoir. State clearly the main objective of each survey.

c. A reservoir bed survey carried out for the feasibility study of a proposed dam yielded following data (Table Q6).

Table Q6

Contour elevation (m) above datum	Area/(ha)	Cost of construction (Rs. millions)	Present value of benefits of the dam (Rs. millions)
100	0	--	--
110	140	4	5
120	320	5	6.2
130	615	6	8.4
140	960	7	8.5
150	1325	8	8.6

Calculate the capacity of the reservoir at various elevations and determine the most economic height of the dam to be constructed here. State the assumptions you make.

7.

Provide answers to any three of the following;

a. Many factors affect the amount of irrigation water required by a plant. List the factors that influence the irrigation water requirement for a given crop.

b. Checking the water tightness of a reservoir is of prime importance when investigating for a good design of the foundations of reservoirs. Discuss the possible causes that would have led to the failure of Samanalawewa reservoir.

c. Operation studies are done to obtain reservoir capacities with better results. Explain how you carryout an operation studies to determine a reservoir capacity.

d. Experiments have shown that productivity of a given quantity of water can be doubled if a scientific water management technique is adopted. As an irrigation engineer, briefly explain your approach in achieving 'scientific water management'.

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