THE OPEN UNIVERSITY OF SRI LANKA
Diploma in Technology (Civil) - Level 4
CEX 4233 - Irrigation Engineering
Final Examination - 2006

049

Date : 03rd April 2006
Time : 13:30 - 16:30 hrs
Duration : Three (03) hours

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

Registration No.....

1.

Samanalawewa reservoir, formed by a 100m high rockfill dam is one of the largest reservoirs built in Sri Lanka in the recent times. Signs of possible leakage through the right bank appeared even during construction of the dam. A number of remediation methods were adopted, but the leakage could not be stopped. The reservoir is presently operating with a continuous leakage of 1800 litres per second.

a. 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 leakage in Samanalawewa reservoir.
b. Suggest remedies to control/ prevent such leakages.
c. Due to the Samanalawewa hydropower project, the people who were resettled suffered economic and social hardship. The project displaced some 30,000 people, flooding 28 square kilometers of the productive and densely populated Dumbara valley. Discuss the socio-economic impacts on the people who were resettled due to Samanalawewa project.

2.

Diversion structures in the form of weirs, barrages or anicuts across natural rivers are used to head up water so that the river can be diverted through a different course or canal.

a. Briefly explain the steps that you follow in diverting water from a river to a canal.
b. Discuss about the uses in constructing an obstruction or a barrier across a river.
c. Give 3 examples of weirs, barrages or anicuts constructed in Sri Lanka.
d. What are the important considerations that must be made in selecting a suitable site for a weir?
e. Many weirs constructed on pervious foundations failed in the course of time. What are the main causes of failure of weirs on pervious foundations?

3.

a. What is meant by consumptive use of water for a crop? On what factors does this depend?
b. 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.
c. During a particular stage of the growth of a crop, consumptive use of water is 2.5 mm/day. Determine the interval in days between irrigations, and the depth of water to be applied when the amount of water available in the soil is 50% of the maximum depth of available water in the root zone, which is 80 mm. Assume irrigation efficiency to be 60%. Indicate the assumptions you make.

4.

Kotmale dam is a rockfill dam built in Sri Lanka as part of the massive Mahaweli project.

a. Discuss why a rockfill dam was selected for the location.
b. Compare rock fill dams against earthen dams and gravity dams.
c. Draw a typical cross - section of a rockfill dam.
d. Explain why earth-rockfill dams are increasingly adopted in preference to other types of dams.
e. Grvity dams and rockfill dams are not suitable for clay foundations. Explain why.

5.

a. Irrigation water may be applied to the crops by various methods. Explain how you select the most suitable method and discuss the various methods that are adopted in applying irrigation water to crops.

b. A plot of land requires 10mm of water per day for 5 days for soaking. It then requires 20 mm of water per day for the next 3 days for tilling, puddling and leveling. Thereafter it requires 15 mm of water per day for the next 6 days for sowing. Transpiration from sowing to harvest is estimated at 450 mm and evaporation for the same period is estimated at 150 mm. If percolation and seepage etc. is estimated at 150mm in total,

   a. Calculate the total water requirement for this plot of land.
   b. If the effective rainfall is 5mm per day for 80 days calculate the field irrigation requirement.
   c. If the earth field canal system losses are estimated at 20%, determine the water requirement at the head of the sluice.

6.

a. Irrigation canals are nothing but earthwork constructions and as such very much susceptible to damage. They therefore require a lot of maintenance, upkeep, watch and ward so as to ensure their continuous efficient functioning. Discuss the various problems, which are posed by the irrigation canals during their use and the appropriate remedial measures.

b. The conveyance system joining two reservoirs consists of a lined canal 2.4 km long followed by a free flow tunnel of 4.8 km long. The discharge required in the conveyance system is 28 m^3s^{-1}. The canal has a bed width of 3m, side slopes 1(V) to 1.5 (H) and a depth of flow of 3m. The hydraulic radius and area of flow in the tunnel are 1.3 m and 13.0 m^2 respectively. Determine the friction slopes in the canal and the tunnel. Take Manning's n for the lined canal as 0.015 and for the lined tunnel as 0.013.

c. An existing unlined canal has the following dimensions;

Width of the bottom	= 2 m
Side slopes	= 1 vertical to 1 horizontal
Depth of flow	= 1.0 m
Bed slope	= 0.0002
Manning's coefficient	= 0.02

Determine the discharge of the canal and comment if the canal would silt or

scour.

7.

Provide answers to any three of the following;

a. Discuss critically the statement 'the banks of an unlined canal are more susceptible to erosion than its bed, and hence the stability of the banks and not of its bed is the governing factor in unlined canal designs.

b. 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?

c. At some point in the history, the capital of Sinhalese kingdom was shifted from dry zone to wet zone. With this shifting of the capital the irrigation system was neglected and gradually went into ruins. Discuss the possible causes for this situation.

d. Operation studies are done to obtain better estimates of reservoir capacities. Explain how you carryout an operation study to determine a reservoir capacity.