The Open University of Sri Lanka

Faculty of Engineering Technology

Industrial Studies (Agriculture) & Technology (Agriculture Engineering)

Programme of Study

Final Examination 2013/2014

AEX4237 – Irrigation & Drainage Engineering

Date : 05/08/2014
Time : 09.30 a.m. – 12.30 p.m.
Duration : Three (03) hours

Registration Number:.....

Section 02 – Answer any four (04) out of the six (06) questions. You may use answer books and/or sheets to answer this section.

1) a) Describe the factors affecting evapotranspiration.

b) A bare land in Nuwara Eliya receives a net radiation of 8 MJ m^{-2} day^{-1}, and 80% of the radiation contributes to evaporate water from soil. If the area is 1.5 hectares, determine the total volume of water evaporated from the land within a week (1 hectare = 10,000 m^2). Assume that a net radiation of 1 MJ m^{-2} is capable of evaporating 4.082 m^3 ha^{-1} of water daily.

2) a) Discuss the main components in a typical sprinkler irrigation system.

b) Describe the methods you may apply to prevent clogging in a drip irrigation system.

c) A farmer starts cultivating tomato on the land mentioned in Question 01 part (b). The land holds 25% and 11% of water at field capacity and permanent wilting point on dry weight basis, respectively. The allowable water depletion percentage for tomato is 40%. The dry bulk density of soil is 1.4 g cm^{-3} and the maximum rooting depth of tomato is 1.2 m. The farmer uses a sprinkler system with 75% application efficiency to irrigate the field. The average reference crop evapotranspiration is 4 mm day^{-1} and the crop co-effiient during the crop development stage is 0.75.

i) Calculate the daily evapotranspiration for tomato during the crop development stage.
ii) Calculate the management allowable deficit percentage on dry weight basis of soil.
iii) Calculate the net irrigation requirement for tomato.
iv) Caltulate the total amount of water that should be supplied to the tomato field.

3) a) Explain the factors to be considered during the following phases of constructing a reservoir: selecting a dam site, designing the reservoir and the dam, and constructing the dam
b) An earthened, trapezoidal channel of straight alignment and uniform cross section has a bottom width of 10 m, side slopes 1:1, channel slope of 3 mm, and high water depth of 5 m. Consider Manning's coefficient as 0.0225.
i) Calculate the cross sectional area of the water flow.
ii) Calculate the wetted perimeter of the channel.
iii) Determine the flow rate in the channel.
iv) If the same water flow is carried in a canal along with silt, determine the flow velocity. (Assume that Lacey's silt factor is 0.85.)

4) a) Explain how you would measure the water flow in a stream.
b) A rectangular weir for flow measurement in a main canal has the following measurements: the head on the weir = 3.5 cm, the length of the weir crest = 12 cm. Calculate the water discharge from the rectangular weir. (C_d = 0.622 and the gravitational force = 9.81 ms^{-2}.)
c) Explain how you would design a triangular weir to discharge water having the same flow rate as in part (b).
d) The discharged water through the weir in part (b) enters branch canals, distributory canals, field canals, and, finally, farm turnouts. If the effective rainfall is 1490 mm and the conveyance efficiency is 65%, calculate the rate of field irrigation requirement.

5) The inter-relationship between irrigation schemes and environment is beneficial for their sustenance. Discuss the effects of irrigation schemes on environment and the effects of environmental processes on irrigation schemes.

6) Describe the causes for drainage problems. Explain the potential solutions that can be applied to overcome these problems.