MINOR 1---PART A (HYDRAULICS) **All questions carry equal marks**

CEL251

Max. Marks: 30 Time: 40 mins

D-25

Q(1) For a specific energy of 1.8 Nm/N, calculate the maximum discharge that may occur in a rectangular channel of 5.0 m width. The channel has a slope of 0.001 and Manning's n = 0.018

Q(2) A triangular channel with a vertex angle of sixty degrees (side slopes at thirty degrees to the vertical) undergoes a hydraulic jump, show that

$$F_{r1} = A\, m^B\, [(1+m+m^2) / (1+m)]^c$$

F_{r1} is the Froude number at section where depth of flow is y_1 and $m = y_1 / y_2$, note that y_1 and y_2 are conjugate depths. Determine the constants A, B and C

Q(3) The width of a rectangular channel is reduced from 2.75 m to 2.0 m and the floor raised by 0.3 m at a section so that it can be used for measuring discharge. What rate of flow is indicated by a drop of 0.15 m in the water elevation at the contracted section when the depth of the approaching flow is 2.0 m?

Q(4) A hydraulically efficient rectangular channel of width **B** is to be designed such that it can carry a normal discharge of 0.8 m^3/s when flowing full. Also, it has to be ensured that the same channel (of width **B**) should also have a normal velocity of 0.4m/s when flowing half full. Assume Chezy's C is $55 m^{1/2}/s$. Determine the width B of the channel and the slope required to satisfy the above mentioned conditions.

Q(5) In a rectangular channel of width 5m, critical depth is observed at a hump of height **h** when the upstream depth is 2m. The section factor for critical flow computation at the hump is $3m^{5/2}$. Determine '**h**'. Assume n=0.001

Part B: Hydrology

Max. Marks 10

Time: 20 mins

1) Estimate the total evaporation in mm from a 1200 ha reservoir in a month of 30 days during which the reservoir level dropped by 0.85 m in response to an average inflow = 0.5 M m^3/day and constant withdrawal = 0.54 M m^3/day. During the month the average daily seepage loss from the reservoir was 2.5 cm, while the total precipitation on the reservoir was 18.5 cm.

(2 Marks)

2) Calculate the vapor pressure, air pressure, relative humidity and air density at an elevation of 1500 m if air pressure = 101 KPa, air temperature = 25^0C and dew point temperature = 20^0C on the ground. Assume lapse rate = 9^0/km for both air temperature and dew point temperature and Gas constant of air = 287 J/Kg.K constant as a function of height. (4 Marks)

3) The rainfall data recorded at a raingauge for a storm is given below. Find the average intensity during the "worst (i.e., maximum rainfall magnitude)" 10-min and 15-min duration? (4 Marks)

Time (5 min intv.)	Accumulated rainfall (cm)
0	0
5	0.36
10	0.5
15	1.17
20	2.17
25	2.84
30	3.81
35	4.56
40	5.46
45	6.73
50	7.42
55	7.89
60	8.13
65	Rain ends

Formulae: $e_s = 611\exp(17.27T/(237.3+T))$; $T_2 = T_1 - \alpha(z_2 - z_1)$; $p_2 = p_1\left(\frac{T_2}{T_1}\right)^{\left(\frac{g}{\alpha R_a}\right)}$;

$q_v = 0.622e/p$