B.E. 7th Semester Examination, December, 2007
Sub: Water Resources Engineering – II (CE-705)

Time: Three hours **Full Marks: 100**

(Figures in the margin indicate full marks)

First Half

(Answer question no. 6 and any three from the rest)

1. (2+13=15)

a) On the basis of isopluvial map of a place, 50 year – 24 hr maximum rainfall is found to be 120mm. What is the probability that 24 hr. rainfall of the place will be equaled or exceeded in 10 years?

b) The following table shows the ordinates of a 12-h UH developed for a particular catchment. Ordinates of a mass curve of rainfall from a severe storm in that catchment are also shown in the table. Using the given mass curve and assuming ϕ index as 0.15 cm/h, develop a design storm for the catchment. How much would be the flood peak, if base flow is 50 m^3/s?

Time (h)	0	12	24	36	48	60	72	84	96	108	120	132
12-h UH ordinate (m^3/s)	0	32	96	130	126	98	75	50	30	15	7	0
Cumulative Rainfall (cm)	0	10.2	30.5	34.0	36.0							

2. (8+7=15)

a) Using Gumbel's Extreme Value Distribution, floods having return periods of 1000 year and 500 year are estimated as 1700 m3/s and 1500 m^3/s, respectively. If a spillway is designed with a capacity of 1800 m^3/s, estimate the Risk of overtopping the spillway within its lifetime of 200 years.

b) Estimate the magnitude of a 1000-year flood, with the following statistical values: $\overline{x}$ = 3300 m^3/s, σ_{n-1} = 567 m^3/s, $\overline{y}$ = 0.5332 and S_n = 1.1004.

3. (15)

The storage, elevation and outflow data of a reservoir are given below:

Elevation (m)	299.5	300.20	300.70	301.20	301.70	302.20	302.70
Storage (Mm^3)	4.8	5.5	6.0	6.6	7.2	7.9	8.8
Outflow discharge (m^3 /s)	0	0	15	40	75	115	160

The spillway crest is at elevation 300.20 m. The following flood flow is expected into the reservoir.

Time (h)	0	3	6	9	12	15	18	21	24	27
Inflow (m^3/s)	10	20	52	60	53	43	32	22	16	10

If the reservoir surface is at elevation 300.20 m at the commencement of the inflow, route the flood to obtain (a) the peak outflow and (b) maximum reservoir elevation, using modified Pul's method.

4. (5+10)

a) Derive the Muskingum equation for channel routing.

b) Route the following flood through a river reach for which K = 22 h and x = 0.25. At time t = 0, the outflow discharge is 40 m^3 /s.

Time (h)	0	12	24	36	48	60	72	84	96	108	120	132	144	156
Inflow (m^3 /s)	40	65	165	250	240	205	170	130	115	85	70	60	54	40

5. (3x5)

a) Enumerate various methods adopted in mitigating flood hazards.

b) Distinguish between Reservoir routing and Channel routing.

c) Classify dam as per IS: 11223-1985.

6. Write a program to determine the return period T of a given flood magnitude XT, N years of record of X, Ybar and SigmaY, using Gumbel's method. (5)

Second Half

(Answer question no. 6 and any three from the rest)

7. (8+7)

a) A watercourse has a culturable command area of 2600 ha. Intensities of irrigation for Kharif, Rabi and perennial Sugarcane are 20%, 40% and 10% respectively. The duty for Kharif, Rabi and Sugarcane are being 1600, 750 and 1800 ha/cumec respectively. Find the discharge required at the head of the watercourse if time factor and capacity factor are 0.3 and 0.8 respectively.

b) Find the depth of each watering and interval between two successive watering from the following data:
Root zone depth = 1.2m, Field Capacity = 30%, PWP = 11%, Dry density of soil = 18 KN/ m^3, Consumptive use of water = 11 mm/day.

8. (9+6)

a) Find the time required for a strip of area of 0.203 ha by a stream of discharge 0.05 m^3 /s assuming average depth of flow and infiltration rate respectively as 6 cm and 5 cm/hr. Also find the maximum area that can be irrigated with this discharge.

b) Describe briefly different methods of flow irrigation.

9. (7+8)

a) The existing ground profile of a command area does not permit to construct irrigation canals with bed slope higher than 1 in 4000. Due to space constraints, ratio of bed width to depth of flow is also to be restricted to 3.7. Soil investigation for the area indicates the critical velocity ratio as 1.1 and Manning's roughness coefficient as 0.023. Design and draw the canal section with side slopes as 1(H) : 2(V).

b) Design a channel to carry a discharge of 50 m^3/s with Lacey's silt factor, f = 1.1.

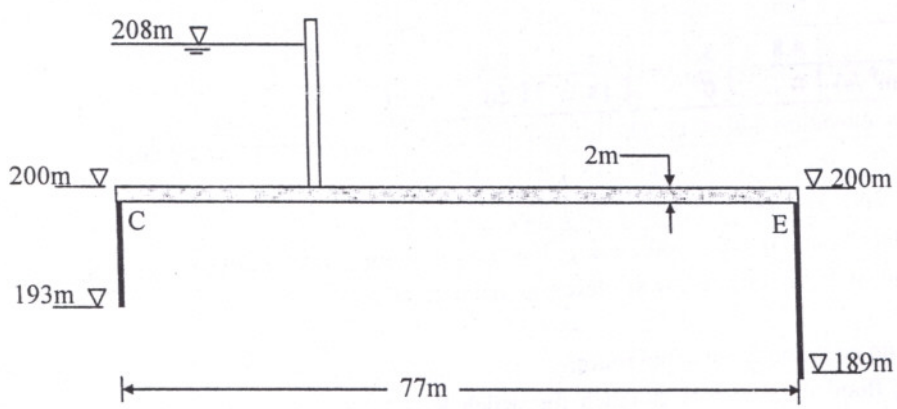
10. (7+8)

a) Design a lined canal to carry a discharge of 100 m^3/s at a bed slope of 1 in 4000. For the lining material to be used, limiting velocity is 2 m/s and Manning's roughness coefficient is 0.015. Side slope may be taken as 1:1.

b) An unlined canal in alluvial soil has a seepage loss of 2.5 cumecs per million square metre of wetted perimeter. The canal has a wetted perimeter of 25m and has maintenance cost of Rs. 0.20/m^2 of wetted perimeter. There is a huge scarcity of water in the area and as such the canal is to be lined with cement concrete lining 12mm thick, so as to reduce seepage loss to 0.02 cumecs/million square metre of wetted perimeter. The lined canal will have a wetted perimeter of 20m. The extra cost of lining works out to be Rs. 20/m^2. If the average annual revenue per cumec of water is Rs. 5.0 lakhs and percentage reduction in annual maintenance cost is 40%, decide whether it is economically feasible to provide canal lining. Assume the life of the canal lining as 50 years and the rate of interest is 6% per anum.

11. (10+5)

a) For the weir profile shown in figure, find the seepage head at points C and E using i) Bligh's creep theory and ii) Khosla's theory (neglect any correction). Also determine the exit gradient.



b) A rectangular channel carrying a supercritical stream is to be provided with a hydraulic jump type energy dissipator. If it is desired to have an energy loss of 5.0m in the jump when the inlet Froude number is 9.0, determine the sequent depths.

12. Write a program to design an irrigation canal using Kennedy's theory, given the critical velocity ratio m, Manning's roughness coefficient n, B/D ratio x and design discharge Q. (5)