Indian Institute of Engineering Science and Technology, Shibpur

M.E. (Civil) 2nd Semester Examination, April, 2014

Sub: Flood Control Engineering (CE-1035)

Time: Three hours Full Marks: 70

Figures in the margin indicate full marks

Answer any five questions

1. (8+6=14)

a) Describe briefly the different non-structural measures for flood mitigation.

b) Enumerate the different mobilization tasks of a flood warning system in different levels.

2. A reservoir has the following elevation, storage, discharge characteristics as follows: (14)

Elevation (m)	Storage ($10^6 \times m^3$)	Outflow Discharge (m^3/s)
299.5	4.8	0
300.2	5.5	0
300.7	6.0	15
301.2	6.6	40
301.7	7.2	75
302.2	7.9	115
302.7	8.8	160

The following flood flow is expected into the reservoir.

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

If the reservoir surface is at elevation 300.0 m at the commencement of the inflow, route the flood to obtain a) outflow hydrograph b) reservoir elevation vs time curve.

3. (10+4=14)

a) Route the following flood hydrograph through a river reach for which Muskingum coefficient K=20h and x = 0.25. Plot the inflow and outflow hydrograph and find the peak lag and attenuation. At 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
Inflow (m^3/s)	40	65	165	250	240	205	170	130	115	85	70	60	54

b) Discuss briefly about hydrologic channel routing.

4. (10+4=14)

a) A 6 hour unit hydrograph is in the form of a triangle with a peak of 50 m^3/s at 24 hours from start. The base is 54 hours. The ordinates of a mass curve of rainfall from a severe storm in the catchment is as below:

Time(h)	0	6	12	18	24
Cumulative rainfall(cm)	0	5	12	15	17.6

Using this data, develop a design storm and estimate the design flood for the catchment. Assume ϕ-index = 0.1 cm/h and base flow is 20 m^3/s.

b) The regression analysis of a 30 year flood data at a point on a river yielded sample mean of 1200 m^3/s and standard deviation of 650 m^3/s. Using Gumbel's method, for what discharge would you design the structure to provide 95% assurance that the structure would not fail in next 50 years? The value of mean and standard deviation of the reduced variate for N = 30 years are 0.53622 and 1.11238 respectively.

5. (10+4=14)

a) The data from an isohyetal map of a 24 hour storm is given below. Assuming that the storm centre had an area of 25 km^2, obtain the Depth-area curve of this storm. Using the depth-area curve, estimate the average depth of rainfall over an area of 2400 sq. km. It can be assumed that the storm is located at the centre of the area.

Isohyet (mm)	21	20	19	18	17	16	15	14	13	12
Enclosed area (Km^2)	543	1345	2030	2545	2955	3280	3535	3710	3880	3915

b) A bridge is designed for a 50 year flood.

i)What is the probability that only one flood of the design capacity or higher will occur in the 75 years life of the bridge?

ii) What is the probability that a flood equal to or greater than a 50 year flood will occur three times in the next 15 years?

6. (8+3+3=14)

a) Briefly explain the methods for detailed flood plain delineation.

b) Discuss briefly the different types of flood damages.

c) Calculate the total damage from a residential property as given below:

Property: Medium size
Flood height: 30.0 m
Ground level: 28.5 m
First floor height: 0.75m above ground level
Velocity of flow: 0.6 m/s
Under-house damage = Rs. 50,000/-
Stage damage = Rs. 7,50,000/-

Take indirect damage as 20% of direct damages.