Bengal Engineering and Science University, Shibpur

M.E. (Civil) 2nd Semester Examination, April, 2013

Sub: Flood Control Engineering (CE-1035)

Time: Three hours | Full Marks: 70

Figures in the margin indicate full marks

Answer any five questions

1. (6+8=14)

a) Mention the different causes of flood.

b) Discuss briefly the different structural measures for flood mitigation.

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

Elevation(m)	100	100.5	101.0	101.5	102.0	102.5	103.0	103.5	104.0
Storage (Mm^3)	3.35	3.47	3.88	4.38	4.88	5.37	5.53	5.87	6.39
Outflow(m^3/s)	0	0	10	26	46	72	100	120	135

When the reservoir elevation was at 100 m, a flood with following hydrograph entered the reservoir.

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66	72
Discharge(m^3/s)	0	20	55	80	75	60	45	35	27	20	14	9	5

Route the following hydrograph and also give the variation of reservoir elevation with time.

3. (10+4=14)

a) Route the following flood hydrograph through a river reach for which Muskingum coefficient K=8h and x = 0.3, outflow being $10.0 m^3/s$ when the flood entered.

Time (h)	0	4	8	12	16	20	24	28	32
Inflow (m^3/s)	10	20	37	38	30	25	19	12	6

Derive the equation you have used.

b) Derive the differential form of continuity equation and the equation of motion in hydraulic flood routing.

4. (10+4=14)

a) The ordinates of a 6-h unit hydrograph are as given below.

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66
Discharge (m^3/s)	0	20	50	130	100	85	62	45	30	20	10	0

Using the data, derive the flood hydrograph due to the storm given below.

Time from beginning of storm (h)	0	6	12	18
Accumulated rainfall (cm)	0	3	8	15

The loss for the storm can be assumed as 0.25 cm/h. Assume base flow to be 25 m^3/s constant throughout.

b) Explain the following: i) Probable Maximum Flood ii) Standard Project Flood

5. (8+6=14)

a) Using 30 years data and Gumbel's method, the flood magnitudes for return periods of 100 and 50 years for a river are found to be 1200 and 1060 m^3/s respectively. For a proposed dam on this river, it is decided to have an acceptable risk of 12% in its expected life of 50 years. Estimate the flood discharge by Gumbel's method for use in the design of this structure. If the actual flood value adopted in the design is 2500 m^3/s, what are the safety factor and safety margin?

b) What are the steps involved in carrying out Depth-area-duration analysis?

6. (8+6=14)

a) Briefly explain different types of flood damages and steps for estimating flood damages.

b) Assess the economic feasibility of a flood mitigation project from the following data. Annual average damage without control measures may be taken as Rs.6000.

Average Recurrence Interval	Total potential damage(Rs.)
10 year	0
100 year	150000
1000 year	400000

7. (10+4 = 14)

a) Discuss briefly the methods for detailed flood plain delineation.

b) List the different components of flood forecasting and warning system.