(b) A sequence of inflows (in thousand cumec) for 30 time periods is given below. Prepare a 3x3 inflow transition probability matrix by calculating transition probabilities by discretising the inflows into three intervals 0-2,2-4,4-6 (3)

T	Q_t	T	Q_t	T	Q_t
1	2.4	11	4.8	21	2.6
2	2.3	12	4.1	22	1.3
3	1.5	13	5.5	23	2.4
4	1.1	14	5.9	24	1.6
5	2.1	15	3.2	25	3.4
6	2.4	16	4.3	26	2.6
7	4.2	17	5.3	27	3.5
8	4.6	18	3.2	28	2.6
9	5.1	19	1.2	29	1.4
10	3.2	20	4.6	30	4.5

8[a] A water resources project has benefits that equal Rs 20 million at the end of first year and increase on a uniform gradient series to Rs 100 million at the of fifth year. The benefits remain constant at Rs 100 million each year until the end of the year 30, after which they decrease to zero on a uniform gradient series at the end of year 40. Calculate the present worth of these benefits using 10 percent interest rate. (3)

[b] Using the equivalent annual cost and present worth basis, determine which of the following projects is preferable at 10% interest? (3)

Particulars	Project A	Project B
Capital Cost (in millions of Rs)	50	40
Annual Operation & Maintenance Cost (in millions of Rs)	2	3.6
Salvage Value(in millions of Rs)	7	6
Service life (in years)	30	30

Total No. of Pages 4 Roll No. .....

SEVENTH SEMESTER B. Tech. CIVIL

SUPPPLEMENTARY EXAMINATION ***FEB-2019***

CE- 413 WATER RESURCES MANAGEMENT

Time: 3:00 Hours *Max. Marks : 40*

Note : Question One is compulsory. Attempt Two questions from Part A and Three from Part B. Assume suitable missing data, if any.

1 Answer eight parts of the question

[a] Write a brief note on probable physical, economical and environmental effects to be kept in mind while planning for water resources project.

[b] Explain the terms: curse of dimensionality, planning horizon and analysis of different un-certainties in water resources.

[c] Enlist different discounting techniques used for economical analysis of projects. How do you select a suitable discounting rate technique for a given water resources problem?

[d] Fuzzification of inputs and defuzzification

[e] Enlist various factors which affect erosion by water. Explain various forms of soil erosion in a catchment due to runoff.

[f] Write a brief note on land capability based on land slope.

[g] Compare various structural methods of soil and management.

[h] Describe the factors influencing rainwater harvesting.

[i] Write a brief note on non-structural methods of flood management.

[j] Enlist the utility of stage-discharge curve and flow-duration curve.

[k] How do you select a suitable unit hydrograph to calculate peak flows for a given catchment area? (1.5*8)

PART- A

2(a) A rectangular parking lot is 140 m x 280 m long. The time of overland flow across the pavement to the longitudinal gutter along the centre is 18 minutes and the estimated total time of concentration to the down stream end of the gutter is 24 minutes. The runoff coefficient is 0.9. If rainfall of intensity 6 cm /hr falls on the lot for 1 minute and stops abruptly, determine the hydrograph upto its peak magnitude. (2.5)

(b) A basin has 415 km^2 of area L=35 km, LCA=10km. Assuming C_t = 1.5 and C_p = 0.7, develop a 3 hour synthetic unit hydrograph. (2.5)

3(a) A drainage basin has 160 km^2 area, 7 hours time of concentration and 9 hours as storage constant with the following information about inter-isochrone area distribution, determine 1 hour unit hydrograph upto its peak value. (2.5)

Time (h)	0-1	1-2	2-3	3-4	4-5	5-6	6-7
Inter isochrones Area (km^2)	10	36	22	43	35	10	4

(b) Design a 140 m long bench terrace for a land having an average slope of 18%. The soil is clay loam. The terrace channel has uniform grade 0.5%. Maximum intensity rainfall expected during the 10 years recurrence interval 10 cm//hr. The values of K, x, a and n may be taken as 6.0, 0.22, 0.5 and 0.8 respectively. (2.5)

4(a) During a flood the water surface at a section in a river was found to increase at a rate of 11.5 cm/h. The slope of the river is 1/3300 and the normal discharge for the river stage read from a steady rating curve was 150m^3/s. If the velocity of flood wave can be assumed as 2.2 m/s, determine the actual discharge. (2.5)

(b) An unregulated stream provides the following volumes through each successive 4-day period over 40 day duration at a possible reservoir site. What should be reservoir capacity needed to ensure maintaining 75% of the average flow over these 40 days, if the reservoir is full to start with? (2.5)

Day	00	4	8	12	16	20	24	28	32	36	40
Runoff volume(Mm^3)	00	10	6	3	4	3	2	1.6	6	16	11

PART- B

5[a] Annual peak flows at a location are known to be exponentially distributed with a mean of 1300 Mm^3. Find the peak flow which has an exceedance probability of 0.75. (3)

[b] Using the benefit cost analysis, determine the optimal scale of development for the following alternatives for a small water resources project. Cost and benefits for different alternatives are given in million Rs. (3)

Alternative	1	2	3	4	5	6	7	8
Cost	7	16	35	69	95	127	154	184
Benefits	7	21	48	94	140	180	197	207

6[a] An irrigation project is to be developed. There is 1800 ha-m of water available annually. Two high value speciality crops, A and B are considered for which water consumption requirements are 1 ha-m per ha and 0.75 ha-m per ha respectively. It has also been determined that the planting of more than 400 ha of crop A and 600 ha of crop B would cause an adverse effect on the market for these special crops. It has been estimated that each ha devoted to crop A will result Rs 3lacs profit, while one ha of crop B will net Rs 5 lacs. Solve the problem for optimality. (3)

[b] A river has total available resources of 900 units. The river basin has one reservoir and two more are contemplated. A minimum of 200 units are allocated to existing reservoir. Determine optimal allocation to the three reservoirs with following net benefits (in Million Rs) for different levels of supply from different reservoirs. (3)

Supply (units)	100	200	300	400	500	600	700	800	900
Net benefits for									
Reservoir 1	150	350	500	620	800	850	870	890	900
Reservoir 2	200	400	550	750	890	1000	1050	1090	
Reservoir 3	230	480	600	720	830	940	1000		

7(a) Estimated costs and benefits from an investment on water resources engineering project over a five years period is provided in a table below. The discounting factors at 10% discounting rate are also provided. Calculate the net present value and the benefits ratio of the project. (3)

Year	Costs	Benefits	Net Benefits	Discounting Factors
1	100	-----	-100	0.909
2	50	-----	-50	0.826
3	---	50	50	0.751
4	----	70	70	0.683
5	---	90	90	0.621