Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (CIVIL ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2018
SUBJECT: HYDROLOGICAL ANALYSIS [CIE 4006]

Date of Exam: 29-11-2018 Time of Exam: 2.00 to 5.00 pm MAX. MARKS: 50

Instructions to Candidates:
- Answer ALL the questions & missing data may be suitably assumed.
- Draw neat sketches wherever necessary

1A.	Define the term "stream order", with a neat sketch. Discuss its significance in hydrological analysis.	**2**	**CO1**
1B.	Discuss any two methods of rainfall data presentation. Explain the procedure for checking the rainfall data for consistency.	**4**	**CO2**
1C.	Compute the runoff volume due to a rainfall of 15cm in a day on a 550ha watershed. The hydrological soil groups are 50% of group C and 50% of group D, randomly distributed in the watershed. The land use is 55% cultivated with good quality bunding and 45% waste land. Assume antecedent moisture condition of Type III and use standard SCS-CN equations.	**4**	**C03**
2A.	Define potential evapotranspiration and factors affecting the same. List the various data needed to use Penman's equation for estimating the potential evapotranspiration from a given area.	**4**	**C03**
2B.	The mass curve of rainfall in a storm of total duration 90 minutes are given below; obtain the ordinates of: (USE NATURAL GRAPH) (i). Plot the maximum intensity (in mm/hr) - duration curve (in minutes) (ii).Plot the maximum depth (in mm) -duration curve (in minutes)	**4**	**CO2**
2C.	Distinguish between; (i) Infiltration capacity and infiltration rate (ii) Depression storage and interception.	**2**	**C03**
3A.	Define the following terms with respect to flood studies (i) Time of concentration (ii) Peak flood (iii) Runoff co-efficient (iv) Peak lag (v) Peak attenuation	**2.5**	**C05**
3B.	A culvert was built to function for a period of 35 years and is designed for a magnitude of return period 100 years. (a) What is the risk of this hydrologic design? (b) If risk of 20% is acceptable, what return period will have to be adopted?	**2.5**	**CO5**
3C.	The stream flows due to three successive storms of 2.9. 4.9 and 3.9 cm of 6 hours duration each on a basin are given below. The area of the basin IS 118.8km^2. Assuming a constant base flow of 20 cumec, derive a 6-hr unit hydrograph for the basin. An average storm loss of 0.15cm/hr can be assumed. (NO GRAPH)	**5**	**C04**

Time (minutes)	0	10	20	30	40	50	60	70	80	90
Cumulative rainfall	0	8	15	25	30	46	55	60	64	67

Time (hr)	0	3	6	9	12	15	18	21	24	27	30	33
Flow (cumec)	20	50	92	140	199	202	204	144	84.5	45.5	29	20

4A. Given the ordinates of a 4hr unit hydrograph as below, derive the ordinates of a 12-hr unit hydrograph for the same catchment by superposition method.
Plot all the columns computed versus time along with the rainfall depth versus time bar graph (ON PLAIN SHEET).

Time (hr)	0	4	8	12	16	20	24	28	32	36	40	44
4hr UHO	0	20	80	130	150	130	90	52	27	15	5	0

6 **CO4**

4B. Describe the S-curve method of developing a 6hr UH by using 12 hr UH of the catchment. **4** **CO4**

5A. The storage, elevation and outflow data of a reservoir are given below:

Elevation (m)	299.50	300.20	300.70	301.20	301.70	302.20	302.70
Storage 10^6 (m^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

When the reservoir level is at 301.20m, the following flood flow is expected into the reservoir. (USE NATURAL GRAPH)

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

Route the flood and obtain the outflow hydrograph.

7 **CO5**

5B. A 100 ha watershed has the following characteristics
(i). Maximum length of travel of water in the catchment = 3500m
(ii). Difference in elevation between the most remote point on the catchment and the outlet = 65m
(iii). Land use/ cover details:

Land use/ cover	Area (ha)	Runoff Co-efficient
Forest	30	0.25
Pasture	10	0.16
Cultivated land	60	0.40

The maximum intensity-duration-frequency relationship for the watershed is given by

$$i = \frac{3.97T^{0.165}}{(D + 0.15)^{0.733}}$$

Where i= intensity in cm/hr, T= Return period in years and D = duration of rainfall in hours. Estimate the 25-year peak runoff from the watershed that can be expected at the outlet of the watershed.

3 **CO5**