## Mid-West University

## **Examinations Management Office**

End Semester Examinations 2081

Bachelor level/ B.E. Hydropower/ 4th Semester

Time: 3 hours

Full Marks: 50 Pass Marks: 25

Subject: Engineering Hydrology (HE444/HE209)

Attempt all the questions

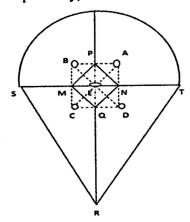
Figures in the margin indicate full marks.

Assume suitable values, with a stipulation, if necessary.

Candidates are required to answer the questions in their own words as far as possible.

1. a) Explain hydrologic cycle with neat sketch. (3)

- b) The catchment area of a reservoir is 15km<sup>2</sup>. A uniform precipitation of 0.7cm/hr for 2hr was observed on a particular day.40% of the runoff reached the reservoir. A canal carrying a flow of 1.5m3/sec is taken from the reservoir. The rate of evaporation was 0.8mm/hr/m<sup>2</sup>. Assuming seepage loss to be 50% of evaporation loss, find the change in reservoir level for 7 hours in the next, if the water spread of the reservoir was 0.55km<sup>2</sup>. (3)
- 2. a) Explain the various methods for measurement of rainfall. (3)
  - b) A semicircle of diameter of 50km with an equilateral triangle of side of 50km below its diameter is a close approximation to a river basin. The position co-ordinates of 5 rain gauge stations A, B, C, D and E located within the basin with respect to the co-ordinate axes system whose X axis and origin coincident with diameter and center of the circle are (10, 10), (-10, 10), (-10, -10), (10, -10) and (0, 0) km respectively. If the rainfall recorded at these rain gauges are 85, 100, 81, 87, 112mm respectively, determine the average depth of rainfall using Thiessen polygon method. (5)



- 3. a) Write penman equation in detail. (3)
  - b) A catchment of 30km² has one recording gauge. The data of mass curve of rainfall during a storm is given below.

Time (hr)	0	2	4	6	8	10	12	14
Cumulative	0	6	17	57	70	81	87	90
rainfall (mm)								

The volume of surface runoff measured is 1.3 million cubic meter. Compute depth of runoff and estimate phi-index. (5)

4. a) The ordinates of a 4 hour UH of a basin of area 25 km<sup>2</sup> are given below.

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t (hr)	0	4	8	12	16	20	24	28	32	36	40	44	48	52	
UH(m <sup>3</sup> /s)	0	40	65	100	140	180	190	170	120	70	45	30	18	0	

- i. 4-hr DRH for a rainfall of 3.25cm with  $\phi$ -index of 0.25cm.
- ii. a 12-hr UH by using the method of superposition.
- iii. a 12-hr UH by using the S-curve method.
- b) A catchment of area 120ha has a time of concentration of 30min and runoff coefficient of 0.3. If a storm of duration 45min results in 3cm of rain over the catchment, estimate the resulting peak flow rate by using rational formula. (3)

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5. a) Given the following data for a stream gauging operation in a river, compute discharge. (5)

Distance from left bank (m)	Depth (m)	Velocity (m/s	s, compute discharge.
0		At 0.6d	At 0.8d
1.5	-	-	-
3.0	1.4	0.7	0.5
4.5	2.7	0.9	0.7
	1.8	0.8	0.5
5.0	1.0	0.6	0.4
	0.4	0.4	0.3
9.0	-	-	

- b) What is flood routing of a reservoir and what are its uses? (3)
- 6. a) For a river, the estimated flood peaks for two year return periods by the use of Gumbels methods are as follows;

Peak flood (m³/sec)
650 .
590

What flood discharge in the river will have a return period of 1000 years? (5)

- b) Explain Dupit's theory and its assumptions for steady flow in to well. A 40cm diameter well penetrating an unconfined aquifer of 25cm thick below water table is pumped at a uniform rate of 700litr/min, till the water level in the well becomes steady. Two observation wells drilled radially at a distance of 20m and 80m from the center of the well, shows depression of 3.2m and 1.1m respectively.
  - i. Determine the permeability of the aquifer.
  - ii. Determine the drawdown at the main well. (6)

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40 0.5436 0.5442 0.5448 0.5458 0.5396 0.5402 0.5410 0.5332 0.5343 0.55   50 0.5485 0.5489 0.5493 0.5453 0.5458 0.5463 0.5468 0.5473 0.5471 0.5   60 0.5521 0.5524 0.5527 0.5527 0.5597 0.5501 0.5504 0.5508 0.5511 0.5515	Table 8-1	: Reduced	mean V								
10  0.4952	N	0	71	Gumbel	s Extreme	Value Distr	ibution			Statistica	il Hydrology
20	10	0.4952	0.4996	- 2	3	4	51				
50 0.5362 0.5371 0.5380 0.5283 0.5296 0.5309 0.5320 0.5321 0.5202 0.5   40 0.5436 0.5442 0.5448 0.5453 0.5456 0.5402 0.5410 0.5418 0.5332 0.5333 0.5   50 0.5485 0.5489 0.5493 0.5453 0.5458 0.5463 0.5468 0.5473 0.5477 0.5   60 0.5521 0.5524 0.5527 0.5530 0.5501 0.5504 0.5508 0.5511 0.5515 0.5			0.5252		3.307		0.5128	0.5157	7	8	- 0
40 0.5436 0.5442 0.5448 0.5453 0.5396 0.5402 0.5410 0.5418 0.5343 0.5   50 0.5485 0.5489 0.5493 0.5453 0.5458 0.5463 0.5468 0.5473 0.5477 0.5   60 0.5521 0.5524 0.5527 0.5537 0.5530 0.5504 0.5508 0.5511 0.5515 0.5		3.3302	0.5371		0.52.83						0.522
50 0.5485 0.5489 0.5493 0.5493 0.5501 0.5504 0.5468 0.5473 0.5477 0.5 60 0.5521 0.5524 0.5527 0.5530 0.5501 0.5504 0.5508 0.5511 0.5515 0.5				0.5448	3.5506	0.5550	5.5462		0.5418		0.5353
0.5521 0.5524 0.5527 0.5520 0.5504 0.5508 0.5511 0.5515 0.				0.5493		0.5456			0.5473		0.5430
				0.5527	0.5530					0.5515	0.5518
70 0.5548 0.5550 0.5552 0.5555 0.5557 0.5559 0.5560 0.5540 0.5543 0.				0.5552					3.3340		0.5545
80 0.5569 0.5570 0.5572 0.5574 0.5576 0.5578 0.5580 0.5865 0.				0.5572	0.5574						415507
90 0.5586 0.5587 0.5589 0.5591 0.5592 0.5593 0.5593 0.5593 0.5583 0.			0.5587	0.5589	0.5591				0.0002		
100 0.5600 0.5590 0.5590 0.5590 0.	100	0.5600						5,555	0.5590	0.3390	0.5599

Table 8-2: Reduced Standard Deviation S<sub>n</sub> in Gumbel's Extreme Value Distribution

1		0	1	2	3	4	5	6	7	el.	
	10	0.9496	0.9676	0.9833	0.9971	1.0095	1.0206	1.0316	1.0411	1.0493	1.056
	20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.108
	30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.138
	40	1.1413	1.1436	1.1458	1.1480	1.1499	1.1519	1.1538	1.1557	1.1574	1.159
	50	1.1607	1.1623	1.1638	1.1658	1.1667	1.1681	1.1696	1.1708	1.1721	1.173
	60	1.1747	1.1759	1.1770	1.1782	1.1793	1.1803	1.1814	1.1824	1.1834	1.184
	70	1.1854	1.1863	1.1873	1.1881	1.1890	1.1898	1.1906	1.1915	1.1923	1.193
	80	1.1938	1.1945	1.1953	1.1959	1.1967	1.1973	1.1980	1.1987	1.1994	1.200
	90	1,2007	1.2013	1.2020	1.2026	1.2032	1.2038	1.2044	1.2049	1.2055	1.206
	100	1.2065									