Mid-West University

Examinations Management Office

End-Semester Examinations -2080

Bachelor level/ B.E. Hydropower/4th Semester | Full Marks: 50
Time: 3 hours | Pass Marks: 25
Subject: Engineering Hydrology (HE209/HE444)

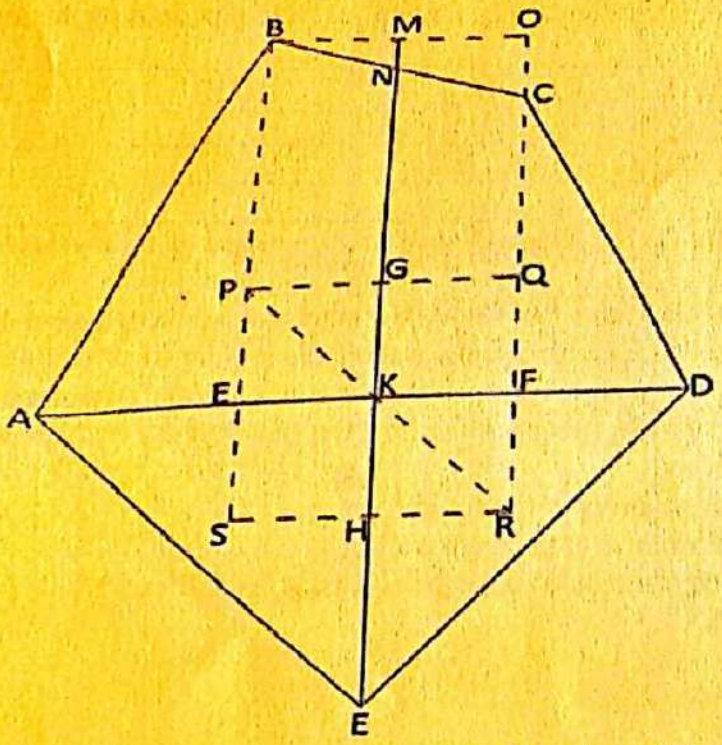
- *Attempt all the questions*
- *Figures in the margin indicate full marks.*
- *Assume suitable values, with a stipulation, if necessary.*
- *Candidates are required to answer the questions in their own words as far as possible.*

1. a) Explain different components of hydrologic cycle with diagram? **[3]**

b) The catchment area of a reservoir is 15km^2. A uniform precipitation of 0.5cm/hr. for 2 hr. was observed on a particular day.50% of the runoff reached the reservoir. A canal carrying a flow of 1m3/sec is taken from the reservoir. The rate of evaporation was 0.7mm/hr./m2. Assuming seepage loss to be 50% of evaporation loss, find the change in reservoir level for 8 hours in the next, if the water spread of the reservoir was 0.45km2. **[3]**

2. a) What is the use of double mass analysis and explain what may be the reasons for inconsistency in the recorded data? **[2]**

b) The shape of a catchment is in the form of a pentagon ABCDE. There are 4 rain gauge stations P,Q,R and S inside the catchment. The position coordinates in km are A(0,0), B(50,75), C(100,70), D(150,0), E(75,-50), P(50,25), Q(100,25), R(100,-25) and S(50,-25).If the rainfalls recorded at P,Q,R and S are 88, 102, 112 and 116mm respectively, determine the mean rainfall by Thiessen Polygon method. **[5]**



3. a) Calculate the evaporation rate from an open water source, if the net radiation is 350w/m2 and the air temperature is 35 degrees Celsius. Assume value of zero for sensible heat, ground heat flux, heat stored in water body and adverted energy. The density of water at 35 degrees Celsius=1010kg/m3. **[4]**

b) A catchment of 30km2 has one recording gauge. The data of mass curve of rainfall during a storm is given below [5]

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

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

4. a) A small stream has trapezoidal section having base width of 12m and side slope 2:1 (H:V) in a reach of 8km. During a flood the high water records at the end of the reach is given below. Estimate the flood discharge of the river. [5]

Section	Elevation of bed (m)	Water surface elevation (m)	Remarks
Upstream	100.2	102.7	Manning's n = 0.03
Downstream	98.6	101.3	

b) Define unit hydrograph with its significance and limitations. [3]

5. a) Given below is a 12-hr Unit hydrograph. Derive 6 hr.-UH by using S-curve method [5]

Time (hr)	0	12	24	36	48	60	72	84	96	108	120
UH (m3/sec)	0	103	279	165	78	45	25	18	9	6	0

b) The basin area of a river is 750km2. Compute the flood of 50 year return period using Modified Dicken's method and WECS method. [4]

6. a) For a river, the estimated flood peaks for two year return periods by the use of Gumbels methods are as follows [5]

Return period(years)	Peak flood (m3/sec)
100	550
50	470

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

b) Explain Dupit 's 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 600litr/minute, till the water level in the well becomes steady. Two observation wells drilled radially at a distance of 20 cm and 80cm from the center of the well, shows depression of 3.2m and 1.1 m respectively. [6]

i)Determine the permeability of the aquifer.

ii)Determine the drawdown at the main well'

iii) At what distance from the well the drawdown is insignificant?

Table 8-1 : Reduced mean $\overline{Y_n}$ in Gumbel's Extreme Value Distribution

N	0	1	2	3	4	5	6	7	8	9
10	0.4952	0.4996	0.5035	0.507	0.51	0.5128	0.5157	0.5181	0.5202	0.522
20	0.5236	0.5252	0.5268	0.5283	0.5296	0.5309	0.5320	0.5332	0.5343	0.5353
30	0.5362	0.5371	0.5380	0.5388	0.5396	0.5402	0.5410	0.5418	0.5424	0.5430
40	0.5436	0.5442	0.5448	0.5453	0.5458	0.5463	0.5468	0.5473	0.5477	0.5481
50	0.5485	0.5489	0.5493	0.5497	0.5501	0.5504	0.5508	0.5511	0.5515	0.5518
60	0.5521	0.5524	0.5527	0.5530	0.5533	0.5535	0.5538	0.5540	0.5543	0.5545
70	0.5548	0.5550	0.5552	0.5555	0.5557	0.5559	0.5561	0.5563	0.5565	0.5567
80	0.5569	0.5570	0.5572	0.5574	0.5576	0.5578	0.5580	0.5581	0.5583	0.5585
90	0.5586	0.5587	0.5589	0.5591	0.5592	0.5593	0.5590	0.5596	0.5590	0.5599
100	0.5600									

Table 8-2 : Reduced Standard Deviation S_n in Gumbel's Extreme Value Distribution

N	0	1	2	3	4	5	6	7	8	9
10	0.9496	0.9676	0.9833	0.9971	1.0095	1.0206	1.0316	1.0411	1.0493	1.0565
20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.1086
30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.1388
40	1.1413	1.1436	1.1458	1.1480	1.1499	1.1519	1.1538	1.1557	1.1574	1.1590
50	1.1607	1.1623	1.1638	1.1658	1.1667	1.1681	1.1696	1.1708	1.1721	1.1734
60	1.1747	1.1759	1.1770	1.1782	1.1793	1.1803	1.1814	1.1824	1.1834	1.1844
70	1.1854	1.1863	1.1873	1.1881	1.1890	1.1898	1.1906	1.1915	1.1923	1.1930
80	1.1938	1.1945	1.1953	1.1959	1.1967	1.1973	1.1980	1.1987	1.1994	1.2001
90	1.2007	1.2013	1.2020	1.2026	1.2032	1.2038	1.2044	1.2049	1.2055	1.2060
100	1.2065									

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