Ref No. –**Ex/PG/CE/T/116B/2025**

M.E.C.E. 1st Year EXAMINATION, 2025
(1st Semester)
SUBJECT: Advanced Hydrology and Ground Water

Full Marks 100

Time: Three hours

Use a separate Answer-Script for each part

No. of Questions — **Part I (60 Marks for This Part)** — **Marks**

Answer Question 1 (compulsory) and any two from the rest. Assume any relevant data if not provided. All the drawings should be in pencil.

Q1. (A) **Writing characteristic features differentiate between:** 2×5

(i) hydraulic conductivity and intrinsic permeability

(ii) mechanical dispersion and hydrodynamic dispersion of ground water pollution transport

(iii) well loss and well efficiency

(iv) storage coefficient and yield coefficient of aquifer

(v) drawdown test and recovery test of well

(B) With neat labelled sketch establish the principle of Ghyben-Herzberg for salt water intrusion in unconfined aquifer. 5+4

Suppose 1m^3 of aquifer is contaminated with 50L 1,1 DCE. The aquifer has porosity of 0.5. Groundwater moves through it with an actual speed of 0.05m/day. The 1.1 DCE has a dissolved concentration equal to 15% of its aqueous solubility. The actual velocity of flow of ground water is 0.5m/d. Assume aqueous solubility of 1.1 DCE is 0.87g/100ml at 20°C and specific gravity 1.22 g/cc. Determine the retardation factor of DCE.

(C) With example list the assumptions involved in the unit hydrograph theory. Why synthetic hydrograph is required to be established? List the parameters to be determined for developing synthetic hydrograph. 3+ 2+3

(D) Why reservoir routing method is also known as level pool method? What is the summation of coefficients in the equation of Muskingum method of flood routing? 2+1

Q2. (A) What will be the shape of the water table for an confined aquifer allowing flow of water between two parallel water bodies of head Y_1 and Y_2 of L distance apart? Establish the equation of drawdown for a well in a confined aquifer under unsteady state condition with a neat labelled sketch. 1+2+4

(B) Determine graphically the aquifer parameters of a confined aquifer if the drawdown time data recorded at an observation well situated at a distance of 12.5 m from the pumping well of 30cm dia having rate of discharge of 1500 lpm are: 8

Time (min)	1.5	3	4.5	6	10	20	40	100
Drawdown (m)	0.15	0.6	1.0	1.4	2.4	3.7	5.1	6.9

Q3. (A) Write the basic equation of hydraulic method of flood routing. With neat sketch discuss prism storage and wedge storage. 2+3

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No. of Questions | **Part I (60 Marks for This Part)** | **Marks**

Q3.(B) The storage elevation and outflow data of a reservoir are given below. 10

Elevation (m)	Storage ($10^6 m^3$)	Discharge (m^3/s)
299.5	4.8	0
300.2	5.5	0
300.7	6.0	15
301.2	6.6	40
301.7	7.2	75
302.2	7.9	115
302.7	8.8	160

The spillway crest is at elevation 300.2m. The following flood flow is expected into the reservoir.

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

If the reservoir surface is at elevation 300 m at the commencement of the inflow, route the flood by Good-rich method and determine and plot attenuation of flood peak and lag time.

Q4. (A) Define S-hydrograph. 2

(B) **Write true or false with justification. <u>No marks will be credited except justification.</u>** 1.5×2

i. The inflection point on the recession side of the hydrograph indicates the end of the direct runoff.

ii. If peak discharges in 2–hr and 4-hr unit hydrographs occur at t1 and t2 time respectively then t1<t2.

(C) The ordinates of 6-h unit hydrograph (UH) are as follows. Derive graphically the ordinates of 3-h unit hydrograph for the same catchment area. 10

Time from start of rainfall (h)	0	6	12	18	24	30	36	42
Ordinates of 6-h UH (m^3/s)	0	30	90	160	120	60	15	0

Ref. No. **Ex/PG/CE/T/116B/2025**

M.E. CIVIL ENGINEERING EXAMINATION 2025
(First Year, First Semester)

ADVANCED HYDROLOGY AND GROUNDWATER

Time: Three Hours

Full Marks 100
[Part I: 60 Marks
Part II: 40 Marks]

Use a separate Answer-Script for each part

<table>
<tr><th>Question No.</th><th>Part II (40 Marks)</th><th>Marks</th></tr>
<tr><td colspan="3"><i>Answer any TWO questions from this part</i></td></tr>
<tr><td>1 (a)</td><td>Explain the stream flow measurement method, with suitable diamgram.</td><td>12</td></tr>
<tr><td>(b)</td><td>What is importance of hydrologic measurements in any water resource project? Explain briefly with example.</td><td>8</td></tr>
<tr><td>2 (a)</td><td>What are hydrologic data?</td><td>3</td></tr>
<tr><td>(b)</td><td>What is hydrologic investigation?</td><td>3</td></tr>
<tr><td>(c)</td><td>Where the hydrologic investigation is required?</td><td>4</td></tr>
<tr><td>(d)</td><td>What is the sequence of hydrologic measurement? Explain each step.</td><td>4+6=10</td></tr>
<tr><td>3 (a)</td><td>What do you mean by atmospheric water, surface water and groundwater? Make a list of them.</td><td>8</td></tr>
<tr><td>(b)</td><td>Write down the measurement procedure of any four hydrologic parameters.</td><td>12</td></tr>
<tr><td>4 (a)</td><td>Estimate the discharge of a particular location of a stream for the data tabulated below.
<table>
<tr><th>Gauge Distance from Initial Point at Bank of the Stream (M)</th><th>Depth, d (m)</th><th>Mean Velocity v (m/s)</th><th>Gauge Distance from Initial Point at Bank of the Stream (M)</th><th>Depth, d (m)</th><th>Mean Velocity v (m/s)</th></tr>
<tr><td>0</td><td>0.0</td><td>0.00</td><td>180</td><td>5.7</td><td>2.25</td></tr>
<tr><td>10</td><td>3.1</td><td>0.37</td><td>190</td><td>5.1</td><td>2.05</td></tr>
<tr><td>30</td><td>4.4</td><td>0.87</td><td>210</td><td>6.0</td><td>1.44</td></tr>
<tr><td>50</td><td>4.6</td><td>1.09</td><td>225</td><td>6.5</td><td>1.32</td></tr>
<tr><td>70</td><td>5.7</td><td>1.34</td><td>240</td><td>7.0</td><td>1.20</td></tr>
<tr><td>90</td><td>4.5</td><td>1.36</td><td>255</td><td>7.2</td><td>1.04</td></tr>
<tr><td>110</td><td>4.4</td><td>1.39</td><td>270</td><td>6.2</td><td>0.86</td></tr>
<tr><td>130</td><td>5.4</td><td>1.42</td><td>285</td><td>5.5</td><td>0.45</td></tr>
<tr><td>150</td><td>6.1</td><td>2.03</td><td>300</td><td>3.6</td><td>0.26</td></tr>
<tr><td>160</td><td>5.8</td><td>2.22</td><td>315</td><td>0.0</td><td>0.00</td></tr>
</table></td><td>12</td></tr>
<tr><td>(b)</td><td>Draw a rating curve, on an appropriate graph sheet, for the total discharge estimated above; assuming initial gauge reading as 4.0m, and the increment of water level is 0.2m/hr for 12 hours.</td><td>8</td></tr>
</table>