

M.E.C.E. 1st Year EXAMINATION, 2024
(1st Semester)

SUBJECT: Advanced Hydrology and Ground Water

Full Marks 100

Time: Three hours

Use a separate Answer-Script for each part

Part I (60 Marks for This Part)

No. of Questions	Part I (60 Marks for This Part)	Marks																		
	<p>Answer Question 1 (compulsory) and any two from the rest. Assume any relevant data if not provided. All the drawings should be in pencil.</p>																			
Q1. (A)	<p>Writing characteristics features differentiate between:</p> <p>(i) hydraulic conductivity and hydraulic diffusivity</p> <p>(ii) molecular diffusion and hydrodynamic dispersion of ground water pollution transport</p> <p>(iii) well loss and well efficiency</p> <p>(iv) specific storage and storage coefficient</p> <p>(v) leaky aquifer and perched aquifer</p>	2×5																		
(B)	<p>With neat labelled sketch justify “for every m of rise of fresh water in an unconfined aquifer above sea level there will be 40m of fresh water in the aquifer below sea level”. Suppose 1m³ of aquifer is contaminated with 40L 1, 2 DCE. The aquifer has porosity of 0.4. Groundwater moves through it with an actual speed of 0.04m/day. The 1.2 DCE has a dissolved concentration equal to 15% of its aqueous solubility. Assume aqueous solubility of 1.2 DCE is 0.87g/100ml and specific gravity 1.253 g/cc. Determine the time required to clean the pollutant from the aquifer through advection process only.</p>	5+4																		
(C)	<p>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.</p>	3+ 2+3																		
(D)	<p>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?</p>	2+1																		
*Q2.	<p>What will be the shape of the water table for an unconfined aquifer allowing flow of water between two parallel water bodies of head Y_1 and Y_2 of L distance apart with recharge from top? Establish the equation of drawdown for a well in a confined aquifer under unsteady state condition with a neat labelled sketch. Determine graphically the aquifer parameters of an confined aquifer if the drawdown time data recorded at an observation well situated at a distance of 50m from the pumping well of 30cm diameter having rate of discharge of 1800 lpm are:</p> <table border="1"> <tr> <td>Time (min)</td> <td>1.5</td> <td>3</td> <td>4.5</td> <td>6</td> <td>10</td> <td>20</td> <td>40</td> <td>100</td> </tr> <tr> <td>Drawdown (m)</td> <td>0.15</td> <td>0.6</td> <td>1.0</td> <td>1.4</td> <td>2.4</td> <td>3.7</td> <td>5.1</td> <td>6.9</td> </tr> </table>	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	1+5+9
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Drawdown (m)	0.15	0.6	1.0	1.4	2.4	3.7	5.1	6.9												
Q3. (A)	<p>Write the basic equation of hydraulic method of flood routing. With neat sketch discuss prism storage and wedge storage.</p>	2+3																		

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No. of
Questions

Marks

Q3.(B)

The storage elevation and outflow data of a reservoir are given below.

10

Elevation (m)	Storage (10^6m^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 Goodrich 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. No marks will be credited except justification.

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 t_1 and t_2 time respectively then $t_1 > t_2$.

(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

M.E. CIVIL ENGINEERING EXAMINATION 2024
(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

Question No.	Part II (40 Marks)		Marks																																																																		
Answer any Two questions from this part																																																																					
1	(a)	Explain the stream flow measurement method, with suitable diagram.	12																																																																		
	(b)	What is importance of hydrologic measurements in any water resource project? Explain briefly with example.	8																																																																		
2	(a)	What are hydrologic data?	3																																																																		
	(b)	What is hydrologic investigation?	3																																																																		
	(c)	Where the hydrologic investigation is required?	4																																																																		
	(d)	What is the sequence of hydrologic measurement? Explain each step.	4+6=10																																																																		
3	(a)	Estimate the discharge of a particular location of a stream for the data tabulated below.	12																																																																		
<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>				Gauge Distance from Initial Point at Bank of the Stream (M)	Depth, d (m)	Mean Velocity v (m/s)	Gauge Distance from Initial Point at Bank of the Stream (M)	Depth, d (m)	Mean Velocity v (m/s)	0	0.0	0.00	180	5.7	2.25	10	3.1	0.37	190	5.1	2.05	30	4.4	0.87	210	6.0	1.44	50	4.6	1.09	225	6.5	1.32	70	5.7	1.34	240	7.0	1.20	90	4.5	1.36	255	7.2	1.04	110	4.4	1.39	270	6.2	0.86	130	5.4	1.42	285	5.5	0.45	150	6.1	2.03	300	3.6	0.26	160	5.8	2.22	315	0.0	0.00
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	(b)	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.	8																																																																		