

Name:	 UPES UNIVERSITY WITH A PURPOSE
Enrolment No:	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2021

Course: Groundwater
Program: B Tech Civil Engineering
Course Code: CIVL 4050

Semester: VII
Time: 03 Hours
Max. Marks: 100

Instructions: Attempt all the questions

SECTION A (5 x 4 = 20 marks)

1. Each Question carries 4 marks
2. Instruction: Complete the statement/Select the correct answer(s)
3. Choose the best possible answer in case of MCQ
4. Also explain your answer in 1-2 line(s)

S. No.		Marks	CO
Q1	A sand sample was found to have a porosity of 60 %. For an aquifer of this material, what will be the specific yield?	4	CO3
Q2	The specific capacity of a well in confined aquifer under equilibrium conditions and within the working limits of drawdown a) can be taken as constant b) decreases as drawdown decreases c) increases as drawdown decreases d) increases or decreases depending upon the size of the well Explain the results with the help of the mathematical relationship.	4	CO1
Q3	What are the minimum number of observation wells required for estimating the direction of groundwater flow?	4	CO2
Q4	Which of the following statement is FALSE ? a) Seepage velocity is larger than the Darcy velocity. b) Hydraulic Gradient is always less than 1. c) Intrinsic permeability does not depend upon fluid properties. d) Groundwater flow is generally laminar. Justify the correct answer using required relationship.	4	CO1
Q5	For 1-D flow in a unconfined aquifer, without recharge, between two water bodies the steady water table profile is: a) Straight line b) Parabola c) An ellipse d) An arc of a circle Write the relationship that validates the answer.	4	CO1

SECTION B (10 x 4 = 40 marks)

1. Each Question carries 10 marks
2. Instruction: Write Short/brief notes

Q6	Explain how confined aquifers are susceptible for groundwater contamination.	10	CO2
Q7	The simplest of the recharge estimation methods is water table fluctuation method. Compare this method with the other recharge techniques.	10	CO1
Q8	Discuss various types of water storage and transmission formations. Which of these suitable for use of groundwater as a water resource?	10	CO1
Q9	Three piezometers are installed in an unconfined aquifer at coordinates (East, North) of A(0,0), B(150,50), and C(50, 150). The water table elevations at these wells under steady conditions were observed as 120.203m, 121.189m and 119.678m, respectively. Estimate the direction of groundwater flow. Another piezometer D was then installed such that it was at a distance of 100m up gradient of C, and it was seen that a tracer took 19 hours and 25 minutes to travel from D to C. If the aquifer porosity is 0.4, estimate its hydraulic conductivity.	10	CO3
OR			
Q9	Estimate the discharge of a well pumping water from a confined aquifer of thickness 20m with the following data: a) Distance of observation well from the pumping well= 100 m b) Drawdown at the observation well after 4 hours of pumping = 1.5 m c) Drawdown at the observation well after 16 hours of pumping = 2.0 m d) Storage coefficient S = 0.0003	10	CO3
SECTION-C (20 x 2 = 40 marks)			
1. Each Question carries 20 marks 2. Instruction: Write long answer.			
Q10	Two rivers A and B are parallel to each other and fully penetrates the unconfined aquifer situated on a horizontal impervious base. The rivers are 4km apart and the aquifer has a permeability of 1.5m/day. In an year, the average water surface elevations of the rivers A and B, measured above the impervious horizontal bed, are 12m and 9m respectively. If the region between the rivers received an annual net infiltration of 20cm in that year, estimate a) The location of the groundwater divide b) The average daily groundwater discharge into the rivers A and B from the aquifer between them. Also, sketch the diagram showing the results and the location of the water divide.	15+5	CO3
OR			
Q10	a) In a recuperation test of a 3.0 m diameter open well the water level changed from Elevation 114.60 m to 115.70 m in 120 minutes. If the water table elevation is 117.00 m, diameter (i) the specific capacity per unit well area of the aquifer and (ii) discharge in the well under a safe drawdown of 2.75 m. b) During a recuperation test, the water in an open well as depressed by pumping by 2.5 m, it recuperated 1.8 m in 80 minutes. Calculate the yield from a well of 4.0 m diameter under a depression head of 3.0 m.	10+10	CO3

Q11	<p>a) Derive the basic differential equation of steady state discharge from a well in an unconfined aquifer and depths of water table at two known positions from the well. State clearly all your assumptions.</p> <p>b) A project of groundwater recharge is to be completed for the Bidholi region, Dehradun. Out of various available groundwater recharge techniques, suggest the best method suited for this region.</p>	10+2+ 8	CO2
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