
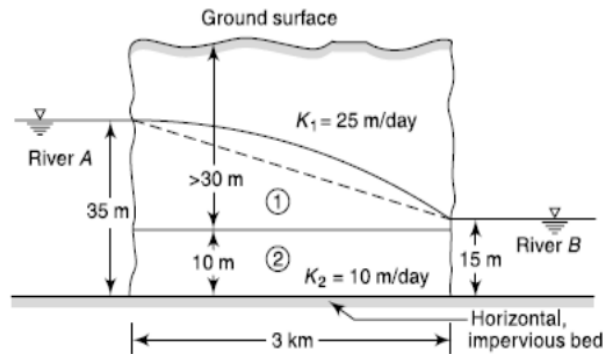


Name:			
Enrolment No:			
UPES End Semester Examination, May 2023			
Course: Groundwater Program: B Tech Civil Engineering Course Code: CIVL 4050P		Semester: VIII Time : 03 hrs. Max. Marks: 100	
Instructions: Attempt all the questions			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	How does the porosity and permeability of an aquifer affect its ability to store and transmit groundwater? Provide examples of aquifers with varying porosity and permeability characteristics.	4	CO1
Q 2	What is the difference between confined and unconfined aquifers? How do the characteristics of these two types of aquifers affect their behavior in terms of groundwater storage and flow?	4	CO1
Q 3	Describe the different types of groundwater recharge and explain how they contribute to the overall water balance of an aquifer system.	4	CO1
Q 4	List out the different factors that govern the groundwater fluctuation and how groundwater fluctuation leads to increase in salinization along the coastal region.	4	CO2
Q 5	Quantify the rate of withdrawal from a 2500 ha reservoir in a month of consecutive 2 months (30+31) days) during which the reservoir level dropped by 0.95 m despite an average inflow into the reservoir of 0.6 million m ³ /day. During the month the average seepage loss from the reservoir was 2.5 cm, the total precipitation was 18.5 cm and total evaporation was 9.5 cm.	4	CO3
SECTION B (4Qx10M= 40 Marks)			
Q 6	Discuss the pumping test and observations of groundwater. Also discuss the assumption and terms used in aquifer testing.	10	CO2
Q 7	A area of catchment 180 km ² received 160cm of rainfall in a whole year. At the outlet of the catchment, the flow in the stream draining the catchment was found to have an average rate of 2.1 m ³ /s for 90 days, 3.1 m ³ /s for 183 days, and 5.1 m ³ /s for 92 days. Calculate response of the catchment area (runoff coefficient) for the rainfall event during the year. If the afforestation of the catchment reduced the runoff coefficient to 0.45, what is the increase in the abstraction from precipitation due to	10	CO4

	infiltration, evaporation, and transpiration, for the same annual rainfall of 130 cm?		
Q 8	<p>A well is drilled into a confined aquifer with a surveyed land surface elevation of 135.15 ft above sea level. The well is 104.27 ft deep with a short screened interval, and the depth to water is 33.78 ft.</p> <p>a) Calculate the total hydraulic head in the well. Draw a picture to illustrate your solution and show all work.</p> <p>b) Revise your answer from part (a) to account for dissolved constituents. Given that the measured water temperature in the well is 17° C, the measured density of water in the well is 1033.352 kg/m³, and the density of pure water at 17° C is 998.77 kg/m³, what is the total freshwater head in this well?</p> <p>c) Discuss your answers from parts (a) and (b) with a logical argument.</p> <p>Note: Please ensure to provide necessary formulas, calculations, and steps to support your answer.</p>	10	CO4
Q 9	<p>You have a well on your farm that has been tested and found to have elevated nitrate levels from the shallow unconfined aquifer. There is a feed lot located 3100 ft upgradient from the well, and the groundwater surface at the feed lot is 27.5 ft higher than it is at your farm. The feedlot has been in operation for about 25 years. The sediment in the shallow aquifer consists of a mixture of sandy gravel and moderately sorted, fine-grained sand with an average hydraulic conductivity of 45 ft/day and an average porosity of 18%.</p> <p>a) Based on this information, is it reasonable to suggest that a contaminant plume from the feed lot has contaminated your well? Ignore the effects of retardation and dispersion as you solve this problem.</p> <p>b) If the sediment in the aquifer has an average porosity of 15% and the viscosity of water increases leading to a change in hydraulic conductivity to 38 ft/day, how long will it take for the porosity to decrease to this level?</p> <p>c) Comment on your answer to part (b) with a logical argument.</p> <p>Note: Please ensure to provide necessary formulas, calculations, and steps to support your answer.</p>	10	CO4
	OR		
	Two parallel rivers A and B are separated by a land mass as shown in Figure. Estimate the seepage discharge from River A to River B per unit length of the rivers.	10	CO4

Consider a unit width of the aquifers.



SECTION-C
(2Qx20M=40 Marks)

Q 11

An unconfined aquifer ($K = 5 \text{ m/day}$) situated on the top of a horizontal impervious layer connects two parallel water bodies M and N which are 1200 m apart. The water surface elevations of M and N, measured above the horizontal impervious bed, are 10.00 m and 8.00 m. If a uniform recharge at the rate of $0.002 \text{ m}^3/\text{day}$ per m^2 of horizontal area occurs on the ground surface, estimate ; (i) the water table profile (ii) the location and elevation of the water table divide (iii) the seepage discharges into the lakes and (iv) the recharge rate at which the water table divide coincides with the upstream edge of the aquifer and the total seepage flow per unit width of the aquifer at this recharge rate ?

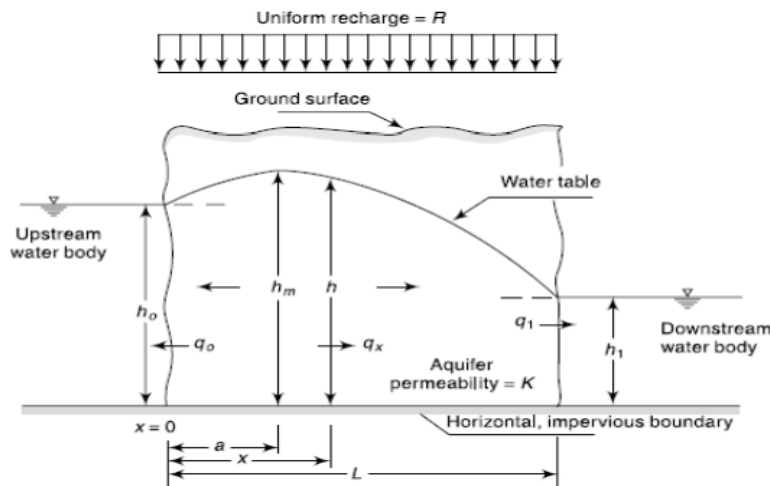


Fig. 6 One Dimensional Dupuit Flow with Recharge

20

CO5

Q 12

- Derive the groundwater flow equation for steady-state flow in a confined aquifer, assuming horizontal flow and negligible vertical leakage. How does the hydraulic conductivity of the aquifer influence the rate of flow?
- Derive an expression for the water table in an unconfined aquifer under steady-state conditions, assuming uniform recharge and

(10 X
2)=20

CO3

	neglecting the effects of pumping. How does the recharge rate influence the position of the water table?		
--	--	--	--