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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SECOND SEMESTER M.TECH DEGREE EXAMINATION, APRIL 2018
(Civil Engineering)
M.Tech. in Water Resources and Hydro-informatics
07CE6404-Advanced Groundwater Hydrology

Time: 3 hours **Max. Marks: 60**

Answer all six questions. Part 'a' of each question is compulsory.
Answer either part 'b' or part 'c' of each question.

Q.no.	Module 1	Marks
1a	Draw a vertical profile of soil strata indicating the zone of saturation, aeration, water table, capillary fringe in case of an unconfined aquifer. Does these zones exist for confined aquifer?.	**4**
	Answer b or c	
b	Define Darcy's law. What are the assumption and limitation in the application of this law. How do you test the whether Darcy;s law is applicable	**5**
c	Derive an equation for land subsidence in terms of the bulk modulii of water, aquifer thickness, storage coefficient and porosity. Estimate the land subsidence if piezometric head drops by 50m in an artiesian aquifer of thickness 40m, having a porosity of 25% and storage coefficient of 0.0003. Bulk modulii of aquifer and water are $1X10^8$ and $2.1X10^9 N/m^2$ respectively.	**5**

Q.no.	Module 2	Marks
2a	List all (at least 8) assumptions and its implications in the derivation of steady radial flow towards a well in a unconfined aquifer.	**4**
	Answer b or c	
b	An aquifer averages 60m in thickness and is 200ha in area. Determine the volume in cubic m of water available if (a) the aquifer is unconfined and is completely drained (b) the aquifer is confined and the piezometric head is lowered from 30m to 10m above the aquifer (c) the aquifer is confined and the head is lowered 55m which brings the water table 25m below the confining layer. Credit will be given for assuming appropriate aquifer parameters	**5**
c	Draw an image well system for a pumping well, located near 45 degree corner with (i) one of the boundaries as recharging and the other as impermeable (ii) both the boundaries are recharging (iii) both boundaries are impermeable	**5**

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Q.no.	Module 3	Marks
3a	Is it possible to apply the solution for unsteady radial flow towards a well in confined aquifer to that in unconfined aquifer? If so, under what conditions it is applicable and states the implication of these assumptions?	**4**
	Answer b or c	
b	The drawdown in an observation well 15 m away from the pumping well are 3 and 4 m after 10 and 100 min of starting pumping. What are the corresponding drawdowns in an observation well 150 m away from the pumping well? What will be corresponding drawdown in a well which is located at 75m.	**5**
c	Illustrate how the aquifer parameters are estimated from the observation	**5**

data from bore well in a leaky aquifer?

Q.no.	Module 4	Marks
4a	Differentiate between open well and tube well. Also discuss the advantages and disadvantages of the both these types	4
	Answer b or c	
b	The coefficient of transmissibility and storage of a non-leaky artesian aquifer are $3X10^5$ lpd/m and $2X10^{-4}$, respectively. The aquifer is bounded on one side by a barrier boundary. A fully penetrating production well has been discharging at a constant rate of 1000lpm. The drawdown in an observation well 40m from the pumping well due to the effects of the barrier boundary for a pumping period of 2hr is 2.5m. What should be the approximate distance of the pumping well from the barrier boundary?	5
c	A 5m diameter open well has a normal water level of 7m below ground level (b.g.l). By pumping the water level in well has been reduced to 16m b.g.l. Water level was recuperated to 9m b.g.l in 1.5hours. Determine the specific yield of the well. Comment on the type of aquifer material. Assume the allowable draw down of the well as 5m. Design a well to take out discharge of 2000lpm.	5

Q.no.	Module 5	Marks
5a	Derive an expression for the depth of sea water interface below an oceanic circular island when there is an infiltration of w and also when there is no infiltration	5
	Answer b or c	
b	Deduce the basic governing equation for conservative contaminant transport modelling	7
c	The interface of salt water and freshwater is located at 32m below ground level at 105m landward. The depth of homogeneous aquifer is 50m below m.s.l. and has a permeability of 100m/day. How much is the fresh water flow into the sea. Estimate the gap through which the fresh water escapes into the sea.	7

Q.no.	Module 6	Marks
6a	How do we use meteorological data in the assessing the groundwater potential?	5
	Answer b or c	
b	How shall the drilling method be superior to the other methods of geophysical exploration? When shall be this method adopted? Advantages and disadvantages of the same	7
c	In seismic refraction method, 5 geophone were placed at 40, 60, 80, 100, and 140 and the time of first arrival of wave in milli seconds are 80, 113, 152, 164, and 182 respectively. Determine the velocity of shock wave in first and second layers and also determine the thickness of the first layer. Comment on the type of layers.	7