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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 Hydroinfromatics

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	Differentiate between (i) aquifer and aquitard (ii) Unconfined aquifer and confined aquifer	**4**
	Answer b or c	
b	Derive an expression for storage coefficient connecting the aquifer properties porosity, density and bulk modulii. Also storage coefficient of a confined aquifer of 25m thickness and porosity 20%. Bulk modulii of aquifer and water are $1X10^8$ and $2.1X10^9 N/m^2$ respectively	**5**
c	The water budget calculation for a lake has been carried out for a year. It is found that the average inflow into the lake is 15cumec and average ourflow is 2 cumec. The average evaporation in that area is 1m per year. Average surface area of the lake is 300 hectres. The storage in the lake is increased by 10cm during the period. Estimate the amount of groundwater recharge/flow into the lake during this one year	**5**

Q.no.	Module 2	Marks
2a	Derive an equation for the steady radial flow towards a fully penetrating well in an unconfined aquifer	**4**
	Answer b or c	
b	A confined aquifer with a transmissibility of 1000 lpm /m is situated above an impervious base and overlain by a semi-confining layer with a resistance of 2000 days against vertical leakage and above this layer a homogeneous aquifer with constant water table is present. From the leaky aquifer water is pumped at a rate of 800 lpm by a fully penetrating well of 30 cm diameter. What is the drawdown in the well and at a distance of 800m from the well, assuming the well yield is balanced by the leakage	**5**
c	Derive Laplace Equation for groundwater flow	**5**

Q.no.	Module 3	Marks
3a	Derive the solution of unsteady groundwater flow equation in the polar coordinates system.	**4**

Answer b or c

b	A 30 cm well 75 m deep is proposed in an aquifer having a transmissibility of $1.5x10^5$ lpd/m and a coefficient of storage of 0.004. The static water level is expected to be 20m below the ground level. Assuming a pumping rate of 2000 lpm, what will be the drawdown in the well after (a) 1 year, (b) 2 years?	**5**
c	Indicate how the Theis method of solution applied for estimating the aquifer parameters?	**5**

Q.no.	**Module 4**	**Marks**
4a	What is meant by well loss coefficient? Illustrate the method of estimating the same by two methods	**4**

Answer b or c

b	Design a well for the flowing data. Discharge required =1500lpm. The available thickness of the confined aquifer is 20m(from -40m to -60m below ground level). The draw down in the well is limited to 13m. The aquifer material has size of D10, D50 and D60 as 0.26mm, 0.43mm,0.65mm respectively. Make suitable assumptions.	**5**
c	Five tube wells of 20 cm diameter are equally spaced along the boundary of a circular well field of radius 200m. The wells fully penetrate an artesian aquifer of thickness 20m, permeability 40 m/day and storage coefficient 0.0002.Calculatethe draw downs in the well after 4 hours of the start of pumping if all the wells have the rate of discharge 800 lpm. What is the draw down at the centre of well field?	**5**

Q.no.	**Module 5**	**Marks**
5a	Describe various water spreading methods of recharge	**5**

Answer b or c

b	What is meant by SAT? What are its components? Also indicate the dynamics of the system by means of a block diagram.	**7**
c	A recharge basin 500X2500m is proposed for a new area with an expected recharge rate of $99Mm^3$.The aquifer has a saturated thickness of 22m and depth to the natural water table is 47m. $T=2000m^2/d$. If the maximum allowable rise of recharge mound is 38m, how far should be the control area established from the centre line of the recharge basin.	**7**

Q.no.	**Module 6**	**Marks**
6a	Illustrate how the depths of water table/layer are determined using resistivity method, elucidating the basic principle behind this method.	**5**

Answer b or c

b	Differentiate between neutron, temperature and Gmma-Gamma logging	**7**
c	What is the underlying principle behind Seismic refraction method. Describe procedure for for determining the aquifer thicknesses. .	**7**