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B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATION, April/May 2014

AGRICULTURAL AND IRRIGATION ENGINEERING BRANCH
FIFTH SEMESTER – (REGULATIONS 2008)

AI 9302 – GROUNDWATER and WELL ENGINEERING

Time : 3 hr
Instructions :

Max. Mark : 100

Question Number 11 is compulsory
Provide additional semilog graph sheet

PART – A [10 * 2 = 20 marks]

1. Write the Dupuit's equation for a one dimensional steady groundwater flow? State its assumption.
2. The coefficient of storage of an artesian aquifer is $3 * 10^{-4}$. If the thickness of the aquifer is 50 m and the porosity 30%, estimate the fraction of the coefficient of storage attributable to expansibility of water and that attributable to the compressibility of the aquifer skeleton. $K_w = 2.1 \text{ GN/m}^2$.
3. Define storage coefficient of Aquifer.
4. Determine the velocity of the groundwater flow if $k = 11.0 \text{ m/day}$, $S_y = 0.1$, Piezometric contour value at up-gradient point = 164 m and Piezometric contour value at down gradient point = 152 m and the average distance between contours = 18 km.
5. Write a steady state three dimensional groundwater flow equation for a homogeneous and isotropic aquifer.
6. Explain steps followed in estimating the aquifer parameters using the Theis Method
7. The draw down is 2 m in an observation well 20 m away from the pumping well after 15 min of pumping. At what time the same draw down will occur in another well 40 m away?
8. Explain the Principle of Law of Times.
9. Explain up coning of saltwater beneath a pumped well in a coastal aquifers.
10. Write short note on groundwater prospecting.

PART – B [5 * 16 = 80 marks]

- 11(i) Why do we need modeling studies? Write classification of models and its application. (6)
- (ii) Explain Model Domain. Spatially and time varying inputs, Initial and Boundary conditions in the groundwater modeling. (10)
- 12a. The following readings were obtained from an NGRI resistivity meter while conducting a resistivity depth probe by Schlumberger method. Draw the resistivity curve and make interpretations for water well drilling. (10)

Distance of potential electrodes MN/2 (m)	Distance of Current electrodes AB/2 (m)	Meter Readings	
		Voltage (mv)	Current (ma)
0.15	1.5	46	25
	2.1	9	12
	3.0	3	9
	4.5	4	26
0.75	4.5	15	26
	6.0	3	9
	9.0	2	11
	15.0	1	14
	21.0	1	17
3.0	15.0	8	17
	21.0	3	11
	30.0	2	12
	45.0	1	16
7.5	45.0	3	16
	60.0	2	16
	90.0	1	17
15.0	90.0	2	17

- (ii) Draw a flow chart to identify the suitable sites for artificial recharge zones using Remote Sensing and GIS technology. (06)

(or)

- 12b. In a refracting shooting, nine geophones were placed along a straight line at a distance of 40, 60, 80, 100, 140, 180, 220, 260 and 320 metres from the shot point. The seismic record gave the following data. Draw the time distance graph and determine the velocity of the shock wave and thickness of each layer.

Geophone	Distance (m)	Time (m-s)	Geophone	Distance (m)	Time(m-s)
G1	40	75	G6	180	200
G2	60	110	G7	220	205
G3	80	150	G8	260	215
G4	100	160	G9	320	225
G5	140	180			

13a. The time drawdown data from an observation well 12.3 m from a pumped well is given in table – 1. The test well is pumped at the rate of 1150 lpm .Static water level in the test well is 2.18 m. Determine the constant T and S by the Jacob's method . Under what condition is this valid.

Table 1 Time drawdown data :

T (min)	0	1	2	3	4	6	8	10	14	18
Depth (m)	2.18	2.42	2.42	2.46	2.5	2.55	2.59	2.63	2.67	2.69

T (min)	22	28	35	45	55	65	80	100	120
Depth (m)	2.71	2.72	2.75	2.82	2.83	2.86	2.87	2.92	2.94

(or)

13b (i) A 30 cm well penetrates 45 m below the static water table. After a long period of pumping at a rate of 1200 lpm, the draw down in the wells 20 and 45 m from the pumped well is found to be 3.8 m and 2.4 m respectively. Determine Transmissivity of the aquifer and also the drawdown in the pumping well. (12)

(ii) A 20 cm well penetrates an artesian aquifer. The length of the strainer is 15 m. What is the yield for a drawdown of 3 m. Assume $K = 35$ m/day and $R = 300$. If the diameter of the well is doubled find the percentage increase in the yield , the other condition remains the same. (04)

14a (i) The results of sieve analysis test carried out on a 500 gm sample of underground aquifer, proposed to be tapped for installation of a tube well, are given in the table below. Design the size of the gravel pack and the slot size for the slotted screen pipes. (10)

Sl. No.	Size of Sieve in mm	Wt. of material retained in gm
1	> 2.54	0.0
2	1.80	6.0
3	0.30	15.0

4	0.25	320.0
5	0.21	5.0
6	0.16	50.0
7	0.12	34.0
8	< 0.12	70.0
	Total	500 gm

(ii) How the well is developed to make it sand free water and to improve its specific capacity and efficiency of the well? (06)

(or)

14b (i) Explain the Jetting method and Core drilling method with neat sketch (10)

(ii) Well Revitalization – Explain (06)

15a How fractures and weathering are formed in rocks? How is it influences the groundwater occurrence and movement?

(or)

15b (i) Explain any two types of pumps used in lifting the water. (08)

(ii) Indicate the practical methods to halt and abate seawater intrusion in the coastal aquifers. (08)