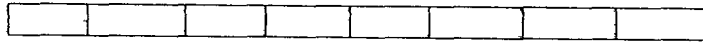


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B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATION, NOVEMBER 2013

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

AI 9302 – GROUNDWATER AND WELL ENGINEERING

Time : 3 hr

Max. Mark : 100

Instructions : Question Number 11 is compulsory

PART – A [10 * 2 = 20 marks]

1. Why do modeling studies are needed? Write classification of models and its application.
2. Under what principle MODFLOW model is working?
3. What do you understand by GALDIT method? Where is it applied?
4. Explain briefly the seismic refraction method.
5. Write the Dupuit's equation for a one dimensional steady groundwater flow? State its assumption.
6. 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. $K_w = 2.1 \text{ GN/m}^2$.
7. What is the average life of tube wells and what are the reasons for their failure?
8. A tube well having a static water level 6 m below ground level has to be pumped at a discharge of $36 \text{ m}^3/\text{hr}$ for a drawdown of 7 m. Water has to be delivered direct to a point 2 m above ground level. Friction losses through pipes and bends are estimated as 2 m. Determine the H.P. of the pump required, assuming an overall efficiency of 60 percent?
9. What are the uses of pump characteristic curves?
10. Explain up-coning of saltwater beneath a pumped well in a coastal aquifers.

PART – B [5 * 16 = 80 marks]

- 11a. What are the main objectives of groundwater monitoring programmes? Explain any two such programs conducted in India. (8)
- 11b. Explain Model Domain. Spatially and time varying inputs, Initial and Boundary conditions in the groundwater modeling. (8)
- 12ai. List the geomorphic control on groundwater and explain any two morphometric parameters which influences the groundwater potential. (8)

- ii. Write the procedure to delineate and to characterize the groundwater potential zones in the hard rock terrain using remote sensing and GIS technique with flow chart. (8)
- (or)
- 12b. Explain the Wenner and Schlumberger electrode arrangement with appropriate electrode connections. What are its various application to groundwater studies?
- 13ai. A 25 cm well penetrates an artesian aquifer of 10 m thick. After 10 hours of pumping at the rate of 1100 lpm the drawdown in the well is 2.6 m and after 48 hours the drawdown is 2.85 m. Determine the T and S of the aquifer. What is the permeability of the aquifer material? After what time the drawdown will be 4.1 m? (8)
- ii. A 30 cm well 75 m deep is proposed in an aquifer having a transmissibility of 1.5×10^5 lpd/m and a coefficient of storage 0.004. The static water level is expected to be 20 m below ground level. Assuming a pumping rate of 2000 lpm. What will be the drawdown in the well after one year and two years? (8)
- (or)
- 13b. Pump test data on a 60 cm well is given in table 1. The well is pumped at the rate of 900 lpm. Determine the aquifer constants T and S. Comment on the hydraulic boundary condition if any. Determine also the distance between the boundary and the pumping well.

Table - 1

Time (min)	10	20	30	40	50	60	80	100	120	150	250	350
s (m)	3.55	3.72	3.82	3.88	3.95	4.00	4.09	4.14	4.18	4.22	4.35	4.44
Time (min)	500	600	800	1000	1300	1600	2000	2500	3000	4000	5000	
s(m)	4.50	4.55	4.59	4.62	4.65	4.69	4.72	4.75	4.77	4.80	4.85	

- 14a. 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 all the components of the water well both for naturally developed and artificially gravel packed cases.

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

(or)

14b. Enumerate the different methods which are used for drilling the tube wells. Discuss any one of these methods in detail with a neat sketch.

15ai. Explain any two types of pumps used in lifting the water. (10)

ii. Explain the artificial recharge methods that is in practice to recharge shallow aquifers. (6)

(or)

15bi. What is range of well yield in a consolidated rocks, semi-consolidated rocks and unconsolidated rocks? (4)

ii. What is the need for groundwater legislation? What sort of rules may help to save the groundwater potential. (4)

iii. By conductivity measurements in a well in a coastal aquifer extending 4 km along the shore, the interface was located at a depth of 20 m below msl at 100 m from the shore, inland. The depth of the homogeneous aquifer is 30 m below m.s.l and has a permeability of 50 m/day. What is the rate of freshwater flow into the sea and the width of gap at the shore bottom through which it escapes into the sea? What is the position of the toe of the saltwater wedge? Use Glover's method. If due to groundwater exploitation, the freshwater flow into the sea is reduced by 80% how far the toe will eventually move? (8)