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B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATION, NOVEMBER 2012

AGRICULTURAL AND IRRIGATION ENGINEERING  
FIFTH SEMESTER – (REGULATIONS 2008)

**AI 9302 – GROUNDWATER AND WELL ENGINEERING**

Time : 3 hr

Max. Mark : 100

Instructions : Question Number 11 is compulsory  
Provide two semi-log sheet

**PART – A [ 10 \* 2 = 20 marks]**

1. What are main pathways in the hydrologic cycle?
2. What is the intrinsic permeability of a water saturated medium that has a hydraulic conductivity of 15.24 m/day?
3. What are the objectives of groundwater monitoring programme?
4. Explain briefly the analog and mathematical modeling?
5. Define electrical resistivity profiling and sounding in geophysical survey.
6. What do you mean by vulnerability index with respect to aquifer pollution? Explain briefly.
7. Compare cable tool and hydraulic rotary methods of drilling.
8. Write short notes on well revitalization.
9. Under what circumstances cavity type tube wells are constructed?
10. What is the simplified freshwater-seawater relation which is universally used?

**PART – B [ 5 \* 16 = 80 marks]**

- 11a. Write the procedure to find the correct value of head at each node. (8)
- b. Derive three dimensional unsteady state groundwater flow equation for a heterogeneous anisotropic aquifer. (8)
- 12a. In a refraction shooting, nine geophones were placed along a straight line at distances 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.

Geophones	Distance form shot-point (m)	Time of first arrival (milli-seconds)
G1	40	75
G2	60	110
G3	80	150
G4	100	160

G5	140	180
G6	180	200
G7	220	205
G8	260	215
G9	320	225

(or)

12b. Develop a methodology to map an aquifer vulnerability, identification of favourable areas for artificial recharge and simulating the effect of artificial recharge.

13a. The time drawdown data from an observation well 12.3 from a pumped well is given in table – 1. The test well is pumped at the rate of 1150lpm. 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)	2.7	2.7	2.7	2.8	2.8	2.8	2.8	2.9	2.9	
	1	2	5	2	3	6	7	2	4	

(or)

13b. Describe briefly the image well theory. An aquifer is bounded by two converging boundaries at an angle of  $45^\circ$ , one being a barrier boundary and the other a recharge boundary. Compute the number of image wells and mark them neatly in a sketch (10)

13c. A 30 cm well 75 m deep is proposed in an aquifer having a transmissibility of  $1.5 \times 10^5$  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? (6)

14a. A fully penetrating well in a confined sandy aquifer has a maximum discharge capacity of 1200 l/min. The aquifer is overlain by impervious formations. The thickness of the aquifer is 20 m. Design the length of the well screen assuming the percentage of the open area of the available strainer to be 15 percent and bore hole diameter as 15 cm. (8)

14b. Explain the design criteria for Artificially gravel packed wells and Naturally developed wells. (8)

(or)