

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2017**  
**(Civil Engineering)**  
**M.Tech in Water Resources and Hydroinformatics**  
**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

<b>Q.no.</b>	<b>Module 1</b>	<b>Marks</b>
<b>1a</b>	Differentiate between (i) aquifuge and aquiclude (ii) Unconfined aquifer and perched aquifer	<b>4</b>

**Answer b or c**

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|----------|--|----------|
| <b>b</b> | Derive an expression for land subsidence connecting the aquifer properties porosity, density and bulk moduli. Also estimate land subsidence of a confined aquifer of 30m thickness and porosity 25%. Bulk moduli of aquifer and water are $1 \times 10^8$ and $2.1 \times 10^9 \text{ N/m}^2$ respectively when the pressure head reduced by 25m | <b>5</b> |
| <b>c</b> | Derive an expression for determining the K using falling head permeability equipment. The experiment was conducted in a soil specimen 20cm high. The diameter ratio for the specimen and tube was 10. Head falls from 90 cm to 45 cm in 5 min. Determine the permeability of the soil sample. Comment on the type of soil.                       | <b>5</b> |

<b>Q.no.</b>	<b>Module 2</b>	<b>Marks</b>
<b>2a</b>	What is meant by partially penetrating wells? How shall the flow phenomenon different from a partially penetrating well when water is pumped out. Also indicate how the discharge is determined in a partially penetrating well	<b>4</b>

**Answer b or c**

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|----------|---|----------|
| <b>b</b> | A 25cm well penetrates 30m below the static water table. After a long period of pumping at the rate of 1300lpm, the draw downs in the observation wells at 25m and 47m from the pumped well are found to be 4.6 and 3.3 respectively. Determine the hydraulic conductivity of the aquifer. Also determine the draw down in the pumped well  | <b>5</b> |
| <b>c</b> | State the darcy's law. What are the conditions to be fulfilled for applying this equation. Two reservoirs are connected by a confined aquifer of length 1000m and thickness 25m. The difference in water levels in the reservoirs is 15m. Hydraulic conductivity of the aquifer is 12m/d. Determine discharge per unit width. Also check whether the darcy's law is applicable assuming it as sand. Viscosity of water is $0.001 \text{ N-s/m}^2$ | <b>5</b> |

<b>Q.no.</b>	<b>Module 3</b>	<b>Marks</b>
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- 3a** Derive the solution for unsteady groundwater flow equation in the polar coordinates system. **4**

**Answer b or c**

- b** A pump test was conducted on a fully penetrating well in an artesian aquifer. Estimate the drawdown in an observation well at 10m, 50m and 200min from the start of pumping;  $Q=2800\text{ lpm}$ ;  $S=0.0000724$  and  $T=1500\text{ lpm/m}$ ; distance of the observation well=20m **5**
- c** An infinite confined aquifer has  $T=25000\text{ lpd/m}$ ;  $S=0.0005$ ; radius of pumping well 15cm; construct a graph showing specific capacity vs time ( $t=1\text{ hr}$ , 1 day, 1 month and 1 year) **5**

**Q.no. Module 4 Marks**

- 4a** Differentiate between yield and specific capacity. What are the methods for testing the yield. Explain any two methods of testing the yield of a tube well. **4**

**Answer b or c**

- b** Design a well for the flowing data. Discharge required  $=1200\text{ lpm}$ . The available thickness of the confined aquifer is 15m(from -45m 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 0.2mm, 0.43mm, 0.5mm respectively. Make suitable assumptions. **5**
- c** The draw down is 2m in an observation well 20m away from the pumping well after 15minute of pumping. At what time the same drawdown will occur in another well 40m away. The following distance and time for having the same draw down (30m, 50min; 50m, 94min; 70m, 182min; 80m, 240min;). One among them does not belong to this pumping data. Identify that data. **5**

**Q.no. Module 5 Marks**

- 5a** Classify the recharge methods based on the method of application. Mention advantages and disadvantages of recharging well system. **5**

**Answer b or c**

- b** A circular island of 600m radius has an effective radius of 5mm/day. A central well 30cm in diameter is pumped at a constant rate of  $80\text{ m}^3/\text{hr}$ .  $K$  for the island is 25m/day. What is the draw down in the well and at the water divide. **7**
- c** A recharge basin  $300 \times 2500\text{ m}$  is proposed for a new area with an expected recharge rate of  $63\text{ Mm}^3$ . The aquifer has a saturated thickness of 20m and depth to the natural water table is 46m.  $T=2200\text{ m}^2/\text{d}$ . 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 temperature logging and Calliper logging **7**
- c** How do you assess the ground water potential for using it as source for water supply scheme. What is role of Remote sensing in such tasks. **7**