Indian Institute of Engineering Science and Technology, Shibpur

M.E. (Civil) 2nd Semester Examination, May, 2014

Sub: Groundwater Hydrology (CE-1017)

Time: Three hours | Full Marks: 70

Figures in the margin indicate full marks

Answer any four questions

1. a) The wells A,B,C tap the same horizontal aquifer, with elevation of water table at 20m,15m , 9m bgl respectively. A is 1100 m north of B and C is 900 m east of B. Determine the direction of flow in this aquifer.

   b) Find the probable land subsidence in the event of 15 m drop in 25 m thick confined aquifer with porosity 40% and storage coefficient of $5x10^{-4}$. Bulk modulus of water may be taken as $2.1x10^5$ N/cm^2.

2. An unconfined aquifer of length L on a horizontal impervious bed is situated between two water bodies with their impervious beds at same level with bottom impervious boundary of the aquifer. The depths of water impounded in the u/s and d/s water bodies are h_1 and h_2 respectively ($h_1>h_2$). There is a recharge at a constant rate R per unit horizontal area due to infiltration from top of the aquifer. The aquifer has infinite length perpendicular to L and a co-efficient of permeability K. Find the flow into the water bodies per unit length perpendicular to L assuming one dimensional flow. What will be these values when there will be no recharge?

3. a) A 30 cm diameter well completely penetrates a 20 m thick confined aquifer. Steady state drawdown, for pumping at constant rate of 1800 liters /min for a long duration, at two observation wells 50m and 125 m away from the pumping wells were found to be 2 m and 1.8m respectively. Find the transmissibility of the aquifer, radius of influence and steady state drawdown in the pumping well.

   b) If the thickness of saturated depth of an unconfined aquifer is 30m, co-efficient permeability of the aquifer is $8x\ 10^{-5}$ m/s, find the safe yield from 50 cm diameter well completely penetrating the aquifer assuming radius of influence as 500m, if permissible drawdown is 3m.

4. a) A 20 cm diameter well completely penetrates a 50 m thick confined aquifer of storage co-efficient 0.005 and co-efficient of permeability 36m/day. Pumping was done at a constant rate of 1800 liters per minute for 24 hrs. Find the draw down in the pumping well and at an observation well 25 m away from the pumping well using Jacob's equation. If the pumping is stopped after 24 hrs, find the recovery of drawdown in the pumping well in next 24 hrs.

   b) In curve matching technique the value of W(u), u, s and r^2/t at the match point were obtained as 1.9, 0.086, 0.4m and 90000m^2/hr for a pumping rate of 2400 liters/minute, from a well completely penetrating a confined aquifer. Find the aquifer parameters.

5. a) Briefly discuss what do you mean by salt water intrusion in coastal aquifers. Also discuss briefly the measures of abatement of salt water intrusion.
   b) Find the length of salt water intrusion from the following data of an unconfined coastal aquifer:
   i) Width of the aquifer- 2.8km
   ii) Thickness of aquifer-30m
   iii) Porosity of aquifer material- 10%
   iv) Co-efficient of permeability of aquifer- 60m/day
   v) Diff in sp. Gravity- 0.03
   vi) Depths of 1500 ppm concentration line from MSL at distances of 150 and 200m from shore line respectively are 15m and 20 m.

6. Write short notes on the following:

   i) Ground water recharge
   ii) Conjunctive use
   iii) Ground water basin management