CVL382: Groundwater

2nd Semester 2018-19
Major Test

Max. Marks: 50
Time: 2 Hour

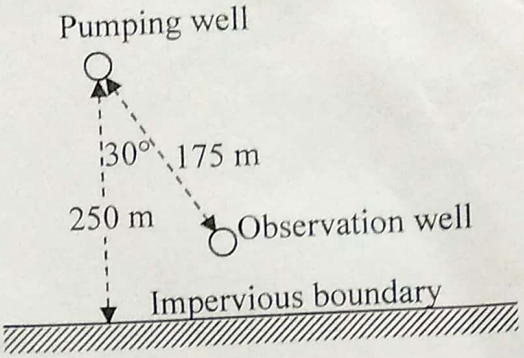
Q. 1. A farmer owns farm of 500 m × 400 m size, in which the initial water table is 2.0 m below the ground level. The underlying aquifer has hydraulic conductivity 1.5 m/day and saturated thickness 25 m. The estimated recharge from irrigation return flow is 5 cm/day. The farmer plans to maintain the water table at-least 3 m below the ground level by a pumping well at centre of a farm for better crop. Determine the steady state minimum pumping rate required for this purpose and also corresponding radius of influence. **(7 Marks)**

Q. 2. A confined aquifer of 40 m thickness is contaminated in area of 600 m wide and 750 m long along regional flow direction. The uniform flow gradient is 0.003 and the aquifer has hydraulic conductivity as 20 m/day. Determine the minimum pumping rate and location of the well to clean-up the aquifer up to maximum extent without extracting water from uncontaminated part of the aquifer. **(6 Marks)**

Q. 3. Three pumping wells (each having dia. = 30 cm) form an equilateral triangle of side 100 m. The wells are fully penetrating in the confined aquifer with hydraulic conductivity = 45 m/day, thickness = 40 m, and storage coefficient = 0.0015. Determine the pumping rates from the wells if the observed drawdowns are: 1.0 m in well 1 after 1 day of pumping, 2.0 m in well 2 after 2 days of pumping and 3.0 m in well 3 after 3 days of pumping. **(8 Marks)**

Q. 4. The foundation in a construction site (80 m by 60 m) is 7.5 m deep while the position of the prevailing water table is 5.0 m below the ground surface. The site is to be dewatered up to 0.5 m below the foundation level in one month using three equal capacity pumping wells (one at centre and two either at corners or at mid points of sides). Determine the preferred location of two pumps and corresponding pumping rate if the initial saturated thickness, the transmissivity and the storage coefficient of the aquifer are 25 m, 1500 m^2/day and 0.15 respectively. **(12 Marks)**

Q. 5. Determine the drawdown in the observation well and percentage contribution in this drawdown by the impervious boundary as shown in the figure after 12 hours of pumping with constant flow rate 50 l/s from a confined aquifer having $S = 4\times10^{-5}$ and $T = 0.0064\ m^2/s$.



(7 Marks)

Q. 6. In an unconfined coastal aquifer with hydraulic conductivity = 30 m/day and underlain by a horizontal impervious layer 40 m below MSL, a fully penetrating well with a constant pumping rate is installed 400 m from the shoreline. If freshwater discharge towards sea is 10 m^3/day/m, determine (a) the location of the toe of the interface before the well installation; (b) the location of the toe; the location of stagnation point and whether brackish water occurs in the pumped water if the well is pumped at 100 m^3/hour; and (c) safe location of the well if the well is pumped at 200 m^3/hour.

Hint $$\frac{(1+\delta)}{\delta^2}\frac{Kb^2}{2q} = x + \frac{Q_w}{4\pi q}\ln\left(\frac{(x-x_w)^2+y^2}{(x+x_w)^2+y^2}\right)$$

(10 Marks)