Section 4

Answer 2

Equation Relating the steady ~~state~~ State Discharge from a well in an unconfined Aquifer.

⇒ ① r = radius of well
H = thickness of the aquifer
S = Drawdown at the well
h = Depth of water in well.

② Considering the origin of co-ordinate at the point O at the centre of the well at its bottom, let the cordinate of any point P on the drawdown curve be (x, y).

Then from Darcy law $Q = k A_x i_x$
where A_x = Area of cross-section.
$= (2\pi x) \times (y) = 2\pi xy$.
i_x = Hydraulic gradient at P $= \frac{dy}{dx}$.

(iii) Discharge $Q = k(2\pi xy)\frac{dy}{dx}$

$$Q\frac{dx}{x} = 2\pi k y dy.$$

(iv) Intergrating between the limits (R, r) for x and (H, h) for y, we get.

$$Q \int_r^R \frac{dx}{x} = 2\pi k \int_h^H y\,dy$$

$$Q [\log x]_r^R = 2\pi k \left[\frac{y^2}{2}\right]_h^H$$

$$Q = \frac{\pi k (H^2 - h^2)}{\log_e \frac{R}{r}} = \frac{1.36\, k (H^2 - h^2)}{\log_{10} \frac{R}{r}}$$