CVL 830 Groundwater Flow and Pollution Modelling

Course Coordinator: Prof. A. K. Keshari
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Marks: 30
Time: 1 hr.
Minor Test I

Answer all questions

[1.] Write down 3D Darcy's law to describe groundwater flow for a homogeneous anisotropic aquifer and enumerate main steps of groundwater modelling. (6)

[2.] **(a)** Derive the one-dimensional Richards equation for flow through unsaturated porous media in terms of moisture content. (5)

(b) The groundwater table in a particular area is 10 m below the ground surface. What will be the thickness of partially saturated zone at a site where the soil is having a moisture content of 30% and the groundwater table is 5 m deep? The laboratory test of unsaturated soil collected from the site shows that it has a void ratio of 0.8 and the effective diameter of soil grains 0.02 mm. The site investigation shows that the soil below the ground surface has a uniform moisture content of 30%. After some time, it is observed that the soil has got contaminated due to leakage from a nearby petrol pump. Obtain contents of various fluid phases present in the soil and draw the initial and final soil moisture profiles. (7)

[3.] **(a)** The infiltration experiment at a particular site reveals that the soil under continuously ponded condition has infiltration capacity of 1.5 cm/hr. If the initial infiltration rate was 7.5 cm/hr, determine the infiltration rate and cumulative infiltration after 2 hr. Assume Horton's constant to be 4.2 hr^{-1}. (4)

(b) Distinguish between followings: (8)

(i) Sand box and electrolytic tank models
(ii) Primary and secondary porosities
(iii) Drainage and imbibition curves
(iv) Single phase and multiphase flows

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