Problem 1 (20 points)

Given a piezometric surface with a regional slope of $7m/km$, calculate the natural rate of groundwater discharge (flux) through a confined aquifer with transmissivity $T = 0.002m^2/sec$.

Problem 2 (20 points)

Three piezometers are located $1000m$ apart in the same horizontal aquifer. Piezometer $A$ is due south of piezometer $B$ and piezometer $C$ is to the east of the line $AB$. The surface elevations of $A$, $B$, and $C$ are 95, 110, and 135$m$, respectively. The depth to water in $A$ is 5$m$, in $B$ is 30$m$, and in $C$ is 35$m$. Determine the direction of groundwater flow through the triangle $ABC$ and calculate hydraulic gradient.

Problem 3 (20 points)

Show that the fluid potential $\Phi = gz + p/\rho$ is an energy term, by carrying out a dimensionless analysis.

Problem 4 (20 points)

Find the constants of integration $a_1$ and $a_2$ in (2.58) and derive (2.60).

Problem 5 (20 points)

Derive the expression for Darcy’s flux (2.63) from (2.60).