Advanced Environmental Hydraulics

2012 Mid-term Quiz

November 12, 2012

1. Circle the correct answer, True (T) or False (F) for each of the following statements (5 points for correct answer, 0 point for no answer, minus 2 point for wrong answer).

(a) Dispersion is mixing by the combined effects of shear and longitudinal diffusion. T F

(b) Strategy of wide disposal is suitable for waste heat. T F

(c) Transports by advection and by diffusion are separate, dependent processes. T F

(d) In turbulent flow, the center of mass of each cloud will tend to return to the origin through the process of ensemble averaging the random motions. T F

(e) The turbulent mixing coefficient is a product of the Lagrangian length scale and the turbulence fluctuation. T F

2. A mass of dye is instantaneously introduced in the straight reach of the small stream. The cross-sectional mean velocity is 0.5 m/s. At the several points downstream of the injection point, concentration of the dye is monitored. Data of concentration-distance distributions are given below. Assume that, through the whole reach of the dye study, transport of the dye can be described by one-dimensional Fickian dispersion model: (a) compute the average value of the dispersion coefficient (m^2/s) using Method of Moment; and (b) estimate length (m) of the dye cloud when 3 hour is elapsed after the injection was started.

Time elapsed after the injection (hr)	0.25	2.50
Variance of concentration-distance distributions (km^2)	0.15	0.35

3. In unified view of diffusion and dispersion, turbulent diffusion is described as the transport associated with fluctuating component of the turbulent action. Using this approach, derive 2-D advection - diffusion equation for turbulent flow.

4. Explain the differences between Taylor Models I and II for shear flow dispersion.