

**CIVE-716 EROSION AND SEDIMENTATION
FINAL EXAM**

Thursday, December 15, 2011, 2:00 -3:50 pm

Name: Julian

Problem #1 (8 points) - Derivations

$$\gamma_{mud} = \frac{W_s}{V_T} = \frac{W_s}{V_s} \frac{V_s}{V_T} = \gamma_s C_v = \gamma_s (1-p_0)$$

- Derive the relationship to obtain the dry specific weight of a sediment mixture given the porosity and specific weight of solids; and
- What is the Riemann condition that we used in Chapter 4?

$$\frac{\partial^2 \Phi}{\partial x^2} = \frac{\partial^2 \Phi}{\partial y^2}$$

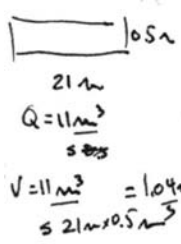
Problem #2 (12 points) - English Units

From the data presented in the Case Study 12.1 for Tarbela Dam on the Indus River:

- what is the suspended sediment discharge in tons per day at a discharge of 50,000 cfs; $\Delta = 100,000 \text{ t/day}$
- what is the dry specific weight of clay in lb/ft^3 when submerged for 200 years; and $30 \text{ kg} + 16 \log 200 = 66.8 \text{ lb}$
- use Eq. 12.8 to find the trap efficiency of $2 \mu\text{m}$ particles at a discharge of 50,000 cfs.

$$T_E = 1 - e^{-\frac{w \cdot W}{u_*' \cdot W}} \quad \omega = 2.6 \times 10^{-3} \text{ mm/s} \quad Q = 50,000 \text{ cfs} = 1415 \text{ m}^3/\text{s} \quad 1 - e^{-\frac{89000 \text{ mm} \cdot 1415 \text{ m}^3/\text{s}}{50000 \text{ cfs} \cdot 1415 \text{ m}^3/\text{s}}} = 0.136 \text{ or } 13.6\%$$

Problem #3 (80 points) - SI Units



Consider the Niobrara River: width = 21 m, depth = 0.5 m, discharge $Q = 11 \text{ m}^3/\text{s}$, $d_{50} = 0.3 \text{ mm}$. Calculate the following at a temperature at 15°C , angle of repose $\phi = 34^\circ$ and slope 170 cm/km:

- Kinematic viscosity
- Shear velocity in m/s
- Dimensionless grain diameter
- Settling velocity
- Critical shear stress in Pa.
- Manning n
- Froude number
- Darcy-Weisbach f
- Grain roughness height
- Transport-stage parameter
- Grain Shields parameter
- Dune height from van Rijn
- Bed load discharge from MPM using τ_*
- Near bed sediment concentration
- Rouse number assuming $\kappa = 0.4$ and $\beta_s = 1$
- Sediment concentration at mid-depth in mg/l
- Bed material discharge from Shen-Hung's method
- Length scale for lateral mixing
- Trap efficiency over 200 m
- What suspended load sampler(s) would you use?

$$\begin{aligned} v &= 1.14 \times 10^{-6} \text{ m}^2/\text{s} \\ u_* &= 0.091 \text{ m/s} \\ d_* &= 6.95 \\ \omega &= 0.042 \text{ m/s} \\ \tau_c &= 0.20 \text{ Pa} \\ n &= 0.024 \\ Fr &= 0.47 \\ f &= 0.061 \\ k_s' &= 0.0018 \text{ m} \\ T &= 6.3 \\ \tau_* &= 0.463 \\ \Delta &= 0.087 \text{ m} \\ Q_{bm} &= 215 \text{ met.tons/d} \\ Ca &= 10^6 \text{ mg/l} \\ Ro &= 115 \\ C_{0.5} &= 494 \text{ mg/l} \\ Q_{bm} &= 369 \text{ met.tons/d} \\ X_t &= 10 \text{ km} \\ T_E &= 0.99 \\ \text{Sampler(s)} &= \text{OH-4B} \end{aligned}$$

IMPORTANT! Attach calculations to test. Happy Holidays!