AE 340, Fall 2006 **Test Exam 1** Name_____

Instructions:

Answer 3/4 out of the 6-8 questions.

No extra credit will be given for more than ?? answers. If more than ?? questions are attempted, CLEARLY indicate which questions are to be graded, otherwise only the first ?? answers will be graded, and the rest ignored.

Show all calculation steps to ensure that partial credit is earned, even if the final answer is incorrect. In cases where the answer is obviously wrong, some credit will be given if you identify this as an improbable answer.

If you make any assumptions, clearly state these assumptions. If you run out of time briefly describe how you would answer the remaining questions, to receive partial credit

Tillage Forces:

$D = F_o*[\sin(\varsigma)+\mu'\cos(\varsigma)] + C_\alpha A_0 \cos(\varsigma) + kb$ Where: $\mu = \tan(\Phi)$, and $\beta = (90- \Phi)/2$

$D^* = W/Z + [CA_1+B]/\{Z*[\sin(\beta)+ \mu\cos(\beta)]\}+ [C_\alpha A_0]/\{Z*[\sin(\varsigma)+\mu'\cos(\varsigma)]\}$

$Z = [\cos(\varsigma)-\mu'\sin(\varsigma)]/[\sin(\varsigma)+\mu'\cos(\varsigma)] + [\cos(\beta) - \mu\sin(\beta)]/[\sin(\beta)+ \mu\cos(\beta)]$

$F_o = [D^* - C_\alpha A_0 \cos(\varsigma)] /[\sin(\varsigma)+\mu'\cos(\varsigma)]$ γ = Bulk density (kg/m^3)

$A_1 = d*b/\{\sin(\beta)\}$ b = tool width (m)

$A_0 = b*L_o$ d = depth (m)

$W = g*\gamma*b*d^\ddagger * [L_o+(L_1+L_2)/2]$ $d^\ddagger = d*[\sin(\varsigma+\beta)]/ \{\sin(\beta)\}$

$B = \gamma*d*b*(V_0)^2*[\sin(\varsigma)]/[\sin(\varsigma + \beta)]$ $L_1 = d*[\cos(\varsigma+\beta)]/ \{\sin(\beta)\}$

g = gravity $L_2 = d^\ddagger *\tan(\varsigma)$

Orifice Flow:

$Q = -.0342 + 770\ A_n* (g*D_e)^{(0.5)}$ Where: D_e=D-k*d (circular)

a'=a-k*d, b'=b-k*d, $D_e = 0.5*a'*b' /(a'+b')$ (rectangular)

Rotary Spreader

$$\{ (C_1+f)\exp[C_2*(C_1-f)*\theta] + (C_1-f)\exp[-C_2*(C_1+f)*\theta] \}/\{2*C_1\} = \{ r_o - (C_3*g)/(C_4*\omega*\omega) \} / \{ C_5\ r_i - (C_3*g)/(C_4*\omega*\omega) \}$$

$$V_r = \omega/(2*C_1) * \{ C_5\ r_i - (f*g)/(\omega*\omega) \} * \{\exp[C_2*(C_1-f)*\theta] - \exp[-C_2*(C_1+f)*\theta] \}$$

$$V_{hr} = \{ (V_r*\cos(\alpha)*\cos(\gamma))^2 + (r_o*\omega + V_r*\cos(\alpha)*\sin(\gamma))^2 \}^{0.5}$$

$$\beta = \text{atan} \{ [V_r*\cos(\alpha)*\cos(\gamma)]/[r_o*\omega + V_r*\cos(\alpha)*\sin(\gamma)]$$

$$V_v = V_r * \sin(\alpha)$$

Where :

$C_1 = (f*f + C_4/C_2)^{0.5}$ $C_2 = \cos(\alpha)$ $C_3 = \sin(\alpha) + f*\cos(\alpha)$

$C_4 = \cos(\alpha) - f*\sin(\alpha)$ $C_5 = \cos(\varsigma) - f*\sin(\varsigma)$ $\gamma = \text{atan} [r_i *\tan(\varsigma)/(r_o - r_i)]$