國立勤益技術學院九十二學年度研究所招生初試試題卷

所別:材化所　組別:　　身分別:一般生及在職生

科目:單元操作及輸送現象　准考證號碼:　　（考生自填）

考生注意事項:

一、每一科目考試時間為 100 分鐘

二、請考生自填准考證號碼

三、請註明題號,並請依題目順序作答,計算過程請詳細列出

一、Please from definition of "shear stress" to identify "momentum flux"?(5%)

二、Please from Reynolds number (N_{Re})discuss creeping flow and potential flow?(5%)

三、What is the Newton's law of viscosity? And from the viscosity to discuss the kind of fluid?(10%)

四、An incompressible fluid is flowing in a horizontal pipe by steady laminar, please prove the friction factor (f)is linear of Reynolds number (N_{Re})?(10%)

五、An incompressible fluid is steady laminar flow in the annular region between two coaxial circular cylinders of outer radius (inner pipe) kR and inner radius (outer pipe)R, please calculate the hydraulic radius?(10%)

六、For the case of laminar flow over a flat plate, the *von K'arm'an* **momentum integral equation is described as follows**

$$\frac{\tau_0}{\rho} = \frac{d}{dx}\int v_x\left(v_\infty - v_x\right)dy$$

where v_∞ **and** δ **respectively mean free-stream velocity and boundary thickness which is a function of** x **,** τ_0 **stands for the shear stress at wall**

$$\tau_0 = \mu\frac{\partial v_x}{\partial y}\Big|_{y=0}$$

Suppose the velocity profile for the laminar boundary layer can be represented by the following second order function

$$v_x = a + by + cy^2$$

Where a, b and c are undetermined coefficients. Please determine

(1) The above velocity profile. You have to list the related boundary conditions.

(2)The boundary layer thickness, δ(x)

(3)The local skin-friction coefficient, C_{fx}

(30%)

七、A tri-effect evaporator concentrates steadily a constant boiling point (bp) solution at a constant heat transfer area. The inlet temperature of steam at first-effect evaporator is 108℃, the bp of solution at third-effect evaporator is 52℃, the overall heat transfer coefficient of first-, second- and third-effect are 2500, 2000,1000, respectively. Please calculate the bp of solution in both the first- and second-effect evaporator? (10%)

八、A water drop(radius R_1, point 1) is steadily evaporated in a stagnant air, the air pressure and temperature are constant, assume the diffusion thickness of gas film is very large (radius R_2, point 2), water content in the air is scarce and all gas are ideal, please derive the molar flux of water evaporation , N_{A2}, is

$$N_{A2} = (D/R_1KT)(P_{A1}-P_{A2})$$

Where D: diffusivity of water in air

K: ideal gas constant

T: temperature

P_{A1},P_{A2}: partial pressure of water gas at point 1, point 2

(20%)