

國立高雄大學 107 學年度研究所碩士班招生考試試題

科目：輸送現象

系所：化學工程及材料工程學系

考試時間：100 分鐘

(無組別)

是否使用計算機：是

本科原始成績：100 分

1. A fluid flows in the x direction, if τ_{yx} is the shear stress as the y -axis; and the negative of velocity gradient, $-dv_x/dy$, as the x -axis. Please plot the relationship between τ_{yx} and $-dv_x/dy$ for the respective following fluid: (a) Newtonian fluid, (b) Bingham fluid, (c) shear-thinning fluid, and (d) shear-thickening fluid. (20%)
2. In the calculation of fluid dynamics and heat transfer, the hydraulic radius (r_h) and equivalent diameter (D_e) are usually calculated. Please explain: (a) hydraulic radius (r_h), (b) equivalent diameter (D_e), and (c) if a fluid flows annular space between outer diameter of D_1 and inner diameter of D_2 in an annular tube, how to express the r_h and D_e . (20%)
3. A Newtonian fluid has density of ρ and viscosity of μ . This fluid performs laminar flows of a falling film with a moving boundary. The maximum thickness of this film is h . Find (a) vertical velocity profile (v_y) of this film and (b) volumetric flow rate (Q). (20%)
4. Consider a hollow spherical heat-transfer medium having inner and outer radii of R_i and R_o with the individual surface temperatures of T_i and T_o . Thermal conductivity is a function of temperature as follows: $k=k_o(1+\alpha T)$, where k_o and α are constants. Calculate the heat-transfer rate in the radial direction at steady state. (20%)
5. A naphthalene (A) particle of diameter d sublimates into a stagnant gas B. (a) Derive the equation for sublimation rate, (b) derive the equation for particle diameter as a function of time. <Notation> D_{AB} : diffusivity; total pressure: P ; radius: r (20%)