

臺灣綜合大學系統 109 學年度學士班轉學生聯合招生考試試題

科目名稱	流體力學	類組代碼	D36
		科目碼	D3692

※本項考試依簡章規定所有考科均「不可」使用計算機。

本科試題共計 2 頁

1. Under which conditions can the Bernoulli equation be applied? (12%)
2. Under which conditions can the concept of potential flow be applied? (12%)
3. What is the physical meanings of stream function? (8%)
4. Consider a laminar flow with dynamical viscosity μ in a pipe that is fully developed, and the axial velocity profile is given by $u(r) = u_c \left[1 - (r/R)^2 \right]$.
 - (a) Please determine the shear rate at the pipe wall ($r = R$). (6%)
 - (b) Please compute the average velocity $\bar{u} = \frac{1}{A} \int_A u dA$ over the cross section. (6%)
 - (c) Let the momentum correction factor and the kinetic energy coefficient are defined by $\overline{u^2} = \alpha \bar{u}^2$ and $\overline{u^3} = \beta \bar{u}^3$, respectively. Please compute the associated α and β . (6%)
5. Consider a turbulent flow of an incompressible fluid past a flat plate, whose width is b and length ℓ . The boundary layer velocity profile is assumed to be $u/U = (y/\delta)^{1/7} = Y^{1/7}$ for $Y = y/\delta \leq 1$ and $u = U$ for $Y > 1$
 - (a) With the above given velocity profile, please compute the momentum thickness, i.e. $\Theta = \Theta(\delta)$; (8%)
 - (b) Please compute the displacement thickness, i.e. $\delta^* = \delta^*(\delta)$; (8%)
 - (c) Please compute the wall shear stress τ_w at the plate surface, i.e. $\tau_w = \tau_w(\rho, U, Re_x)$; (8%)
 - (d) (10%) Please compute the corresponding friction drag coefficient $C_{Df} = C_{Df}(Re_\ell)$, where $D_f = \frac{1}{2} \rho U^2 C_{Df} A = \int_0^\ell b \tau_w dx$.

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6. Water flows down the face of the dam shown in Fig. Q6. The face of the dam consists of two circular arcs with radii of 4.0 and 6.0 m, respectively. If the speed of the water along streamline A-B is approximately $V = (2gh)^{1/2}$, please determine

- the relation between h and the distance s along the stream line, i.e. $h = h(s)$; (8%)
- the normal acceleration as a function of s , i.e. $a_n = a_n(s)$. (8%)

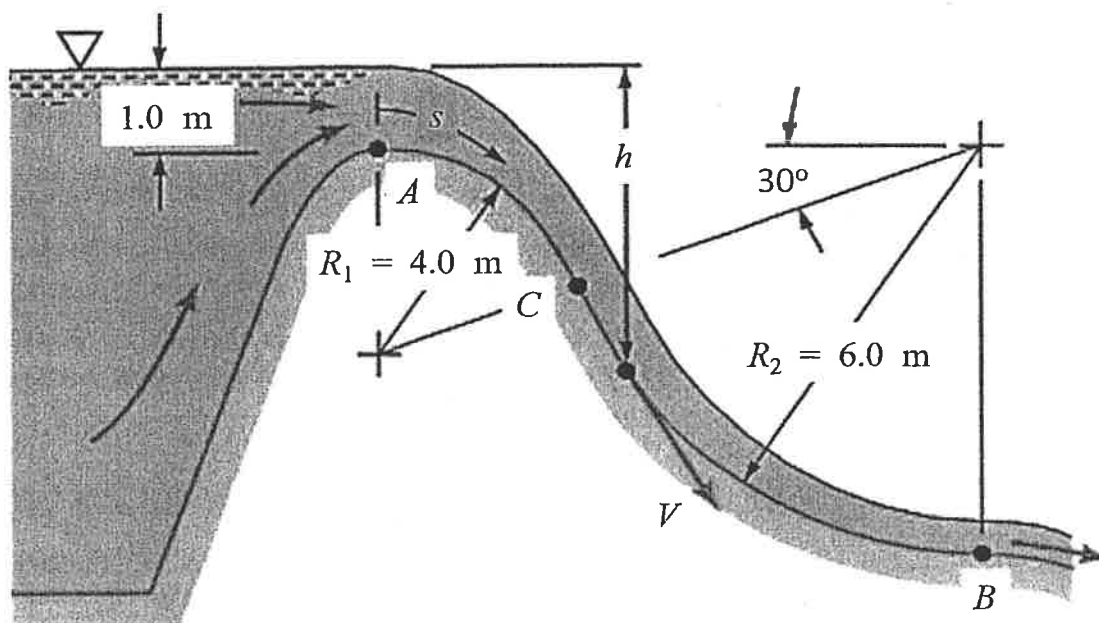


Fig. Q6