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| 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 1 頁 |       |
| (1) (a) Explain “incompressible fluid” (5 pts)<br>(b) Explain “irrotational flow” (5 pts)<br>(c) Explain “potential flow” (5 pts)<br>(d) Explain the differences between the “forced vortex” and “free vortex” (5 pts)<br>(e) Explain “Kelvin’s (circulation) theorem” (5 pts)  |      |            |       |
| (2) If there is a unsteady flow field whose velocity components in the $x$ -direction and $y$ -direction being $u = t^2$ and $v = 1 - t$ , respectively<br>(a) determine the equation $y(x)$ describing the streamline passing through point $x = 0$ and $y = 0$ at time $t = 2$ (10 pts)<br>(b) Determine the equations $x(t)$ and $y(t)$ for a particle path passing through point $x = 0$ and $y = 0$ at time $t = 2$ (15 pts) |      |            |       |
| (3) Given that the streamfunction of a flow is $\psi = \sin(\pi x)\sin(\pi y)$ ,<br>(a) Determine the velocity field: $u(x, y)$ and $v(x, y)$ (5 pts)<br>(b) Show whether the flow is irrotational (10 pts)<br>(c) Determine the acceleration of a fluid particle located at $x = 1$ and $y = \frac{1}{2}$ (10 pts)   |      |            |       |
| (4) If there is the velocity profile of a flow whose components in the $x$ -direction, $y$ -direction, and $z$ -direction, respectively, being<br>$u = 3y + 2y^2,$ $v = 0,$ $w = 0,$ Use Navier-Stokes equations to derive the pressure gradient, $\vec{\nabla}p$ , assuming gravity $\vec{g}$ is oriented in negative $y$ -direction. (25 pts)   |      |            |       |