

ENGINEERING TRIPOS PART IB
Paper 4: THERMOFLUID MECHANICS

ANSWERS

- 1(a) (i) 437kJ/kg (ii) 256kJ/kg (iii) 0.376
(b) (i) 352kJ/kg (ii) 0.362
(c) 406kJ/kg

- 2(a) (ii) 2664kW; 526kW
(b) (i) 26.6kg/s (ii) 1007kW
(c) (i) 784kW

- 3(a) (ii) 69.3W/°C
(b) 0.0796kg/s (air); 0.0956kg/s (water)
(c) 60°C (air); 51°C (water)
(d) 0.166kg/s

- 4(a) $p_1 = p_s - \frac{1}{2}\rho \left(\frac{Q}{A_1}\right)^2$; $p_2 = p_s - \frac{1}{2}\rho \left(\frac{Q}{A_2}\right)^2$
(b) (i) $\frac{1}{2}\rho Q^2 \left[\frac{1}{A_2} - \frac{1}{A_1}\right] - p_s(A_1 - A_2)$ (ii) $\frac{\rho Q^2}{2A_1A_2}$
(c) (i) $\frac{kA_2\rho Q^2}{2A_1^2}$

- 5(b) $p_r = \frac{3\mu HL}{h^3} U_p$
(c) $p_r = \frac{3\mu HL}{h^3} U_p + \frac{1}{2}\rho U_p^2 \left[\left(\frac{H}{h}\right)^2 - 1\right]$

- 6(a) 138W
(b) 51
(c) 0.00874m³/s (tank 1); 0.00437m³/s (tank 2)