2012 PART 1A P2 - Structures and Materials Dr M DeJong

1. (a) $V_A = 2P$, $V_C = -2P$, $H_A = P$; (b) -

2. (a) $\left(5+8\sqrt{2}\right)*WL/AE$; (b) $-5*WL/AE$

3. (a) $V_A = 7P/8$, $V_E = 9P/8$, $H_A = 5P/4$, $H_E = -5P/4$; (b) $x = 7L/5$

4. $v(x) = \frac{1}{EI}\left(-\frac{wLx^3}{8} + \frac{wL^2x^2}{4} - \frac{wL^3}{12}\right)$

5. (a) - ; (b) $v(x) = \frac{M_o}{P}\left(1 - \cos\sqrt{\frac{P}{EI}}x\right)$; (c) $P_E = \frac{\pi^2 EI}{L^2}$; (d) $P_{E,Fig.5b} = 4P_{E,Fig.5a}$;

   (e) i) $W_{\text{failure}} = 461$ N ; ii) $W_{\text{failure}} \approx 250$ N

6. (a) $T_{AB} = T_{BC} = \frac{m_1 g}{2\sin\beta}$, $T_{CD} = m_2 g$; (b) $\mu = \left|\frac{\ln(2\sin\beta)}{\beta + \pi/2}\right|$;

   (c) i) $V_{max} = \sqrt{3}mg$, $M_{max} = \sqrt{3}mgL/2$;

   ii) $\sigma_{max} = \frac{\sqrt{3}}{2}\frac{mgL}{\pi R^2 t}$ at extreme fiber at support ;

   iii) $\tau_{max} = \frac{\sqrt{3}mg}{\pi Rt}$ at neutral axis between support and cable

Part IA 2011-12 Paper 2 Section B: short answers

Q7. (b) $\mu = \dfrac{\tau_s}{H}$

Q9. (b) (i) $\beta < \dfrac{1}{2}\sqrt{\dfrac{a_1}{a_2}}$ (ii) σ = 276 MPa

(c) (ii) $K = \sigma\sqrt{\pi a}$, $K = \left(\sigma - \sigma_f\right)\sqrt{\pi a}$

Q10. (a) (ii) ceramics, composites, natural materials (b) steel (£38.95)

(c) deflection $\delta = \dfrac{Wh}{Eb^2}\left(\dfrac{1-\nu-2\nu^2}{1-\nu^2}\right)$

Q12. (b) $\sigma_t = \sigma_n\left(1+\varepsilon_n\right)$, σ_t = 791 MPa