

Engineering Tripos Part IIA 2003

Module 3C4

Machine Design – Transmissions

1. (a) 
$$\frac{\omega_o}{\omega_i} = \frac{1 + R_1 + R_2 - 0.2R_1R_2}{(1 + R_1)(1 + R_2)}$$

- (b) (i) 250 Nm  
(ii) 250 Nm  
(iii) 240 Nm

2. (b) (ii) 
$$\frac{2}{3}\omega^2$$

3. (b) (i)  $C=67$  kN, bearing 6409, outer diameter 120 mm  
(ii) roller bearing at A,  $C=55.5$  kN, bearing 209, outer diameter 85mm  
deep groove ball bearing at B,  $C=48.8$  kN, bearing 6309, outer diameter 100 mm

4. (b) 
$$V = \frac{\omega_2}{\omega_1} = \frac{\rho}{\rho - 1}$$

(c) 
$$\frac{P_0}{P_1} = \frac{\eta(V\alpha + 1)}{\eta + V\alpha}$$

(d) 
$$0.107 > \frac{\omega_3}{\omega_1} > -0.25$$