

Answers 3C8 2010

1 (b) $(1+R)\left(\frac{a}{2b}\right)V - R\Omega$

(c) $T_{turbine} = \frac{aV}{2}, \quad T_{motor/gen} = -\frac{1}{(1+R)}\frac{aV}{2}, \quad T_{gen} = -\frac{R}{(1+R)}\frac{aV}{2}$

(d) $0 < V < \frac{R}{(1+R)}\frac{2b}{a}\Omega$

2 (b) $a = \left(\frac{3PR}{4E^*}\right)^{\frac{1}{3}}, \quad T = \frac{k\pi w}{2}\left(\frac{3PR}{4E^*}\right)^{\frac{4}{3}}$

(c) $T' = 4\pi a^2 \mu A$

(d) $\frac{T'}{T} = \frac{8}{3} \frac{\mu E^*}{kw\pi R}$

3 (b) (i) $F_{aA} = 5.6 \text{ kN}, \quad F_{aB} = 10.0 \text{ kN}$

(ii) 12.5 kN

(c) $4.9 \text{ million revolutions}$

4 (b) (i) 2 kNm

(ii) 4 kNm

(iii) 357 Nm