

Engineering Tripos Part IA

Paper 1 Mechanical Engineering

Part A: Fluid Mechanics and Thermodynamics

Numerical answer to questions

1. $F = 27.9\text{N}$
2. $F = 35.3\text{ kN}$
3. -
4. $m = 0.373\text{ kg}$, $P = 150\text{ kPa}$, $Q = - 370\text{ kJ}$
5. (c) $C = 0.211$, (e) $\Delta P = 6760\text{ Pa}$
6. (b) $\eta = 42.5\%$, $\eta_{\max} = 52.1$, (c) $w_{\max} = 92.1\text{ MJ}$, (d) 92.1 MJ

Engineering Tripos Part IA, 2007 - Paper 1, Section B – Answers

- 7 (a) $\frac{\omega m a^2}{3}$ (b) $\frac{\omega}{4}$ (c) $\frac{3}{4}$
- 8 (b) $2m$
- 9 (a) 0.56 m/s (b) 0.97 m/s
- 10 (a) $\frac{CR_1R_2}{R_1 + R_2}$ and $\frac{R_2}{R_1 + R_2}$
- 11 (a) -1.8 rad/s and 1.2 m/s (b) -3.36 rad/s^2 and -2.88 m/s^2
(c) 48.6° and -48.6° respectively (d) 15 rad/s when $\theta = 0$ and $AC = 0.1 \text{ m}$
- 12 (a) 0.4 mm (b) $\begin{bmatrix} m & 0 \\ 0 & 2m \end{bmatrix}$, $\begin{bmatrix} 2k & -2k \\ -2k & 3k \end{bmatrix}$ and $\begin{bmatrix} 0 \\ k \end{bmatrix}$
(c) 0.05 mm (d) $0.560\sqrt{\frac{k}{m}}$ and $1.785\sqrt{\frac{k}{m}}$

Numerical Answers. Paper 2 Materials 1A 2007

7) Energy/vol= $\sigma_y^2/6E$.

8) i) $\sigma=113$, ii) $\sigma=0$, iii) $\sigma=212$, $\sigma=299$ MPa.

Audience $\sqrt{2}$ times stronger.

12) 0.35 mm.

Part 1A paper 3 2006 answers

1. $L/C=R_2R_4$, $R_1R_4=R_2R_3$, $\omega^2=1/C^2R_3R_4$
2. $V_2/V_1=A(R_1+R_2)/(R_1+R_2+AR_2)$, 75.9, 0.114 Ω , 139.6 μF
3. 10k Ω , 43.3 k Ω , -88.13
4. 638 W, 247.6 V, 1.7 mF
5. $N_1/N_2=2$, $R_0=3.84$ k Ω , $X_0=1.263$ k Ω , $R_{t1}=3.33$ Ω , $X_{t1}=12.91$ Ω .
6. $J_A = Q_B S$, $K_A = Q_B Q_A$, $J_B = U \overline{D} \overline{S} \overline{Q}_A + \overline{U} \overline{D} \overline{S} \overline{Q}_A$, $K_B = S + D Q_A + U \overline{Q}_A$
7. -1.3 V, 286 Ω , 0.039 V, 1.28
8. $A = \overline{D}$ or $B = \overline{C}$
9. Add $\overline{A}C$
10. 400 V/m
11. 50×10^{-12} Wb, 64 turns
12. 86 mT

