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Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

Complete, fold and seal
(see note 2 below)

SURNAME:

Kot

FORENAME(S):

Jakub

1	Student Number	1701919
2	Title of Examination Paper	Mechanical Principles
3	Module Code	M5X02201
4	Date and Time of Examination	10/05/2019 12:00
5	Examination Venue	IQ310
6	Seat Number	G016
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	10
2	10
3	10
4	10
5	10
Total	50

1) $P = 20000$ $N = 4000$ $\omega = 418.88 \text{ rad/s}$
 $\mu = 0.25$ $r_1 = 0.04$ $r_2 = 0.08$
 $U = 600$

a) $T = \frac{2}{3} \mu W \frac{(r_2^3 - r_1^3)}{(r_2^2 - r_1^2)} \times 2n$ $\rightarrow = 0.0933$ $r_2^3 - r_1^3 = 0.000448$
 $r_2^2 - r_1^2 = 0.0048$

$$T = \frac{P}{\omega}$$

$$T = \frac{20000}{418.88}$$

$$T = 47.75 \text{ Nm}$$

$$2n = \frac{2 \mu W (r_2^3 - r_1^3)}{3 T (r_2^2 - r_1^2)}$$

$$n = \frac{2 \times 0.25 \times 600 (0.08^3 - 0.04^3)}{6 \times 47.75 \times (0.08^2 - 0.04^2)}$$

$$n = \frac{300 (0.000448)}{286.5 (0.0048)} = \frac{0.1344}{1.3652} = 0.0977$$

$$T = \frac{2}{3} 0.0933 \mu W \times 2n$$

$$47.75 = 18.666n$$

$$n = 2.56 \therefore \underline{\underline{3 \text{ plates}}}$$

b) $T = \frac{\mu W (r_2 + r_1)}{2} \times 2n$

$$47.75 = \frac{0.25 \times 600 (0.08 + 0.04)}{2} \times 2n$$

$$47.75 = 18n$$

$$n = 2.65 \therefore \underline{\underline{3 \text{ plates}}}$$

3) a)

	Mass(kg)	r (mm)	M_r (kgmm)	xc (mm)	M_{rx} (kgmm ²)
A	M_a	28	$28M_a$	0	0
B	5	20	100	80	8000 ✓
C	3	50	150	150	22500 ✓
D	M_d	28	$28M_d$	250	$7000M_d$

b) 1:100 scale 80mm@45° 225mm@105°



Diagrams on next pages

$$120 + 20.8^\circ = \underline{140.8^\circ}$$

$$7000M_d = 21400$$

$$M_d = \underline{\underline{3.129 \text{ kg @ } 140.8^\circ}}$$

c) $28M_d = 87.612$



scale 1:1 100@45 150@105 87.6@-200.8

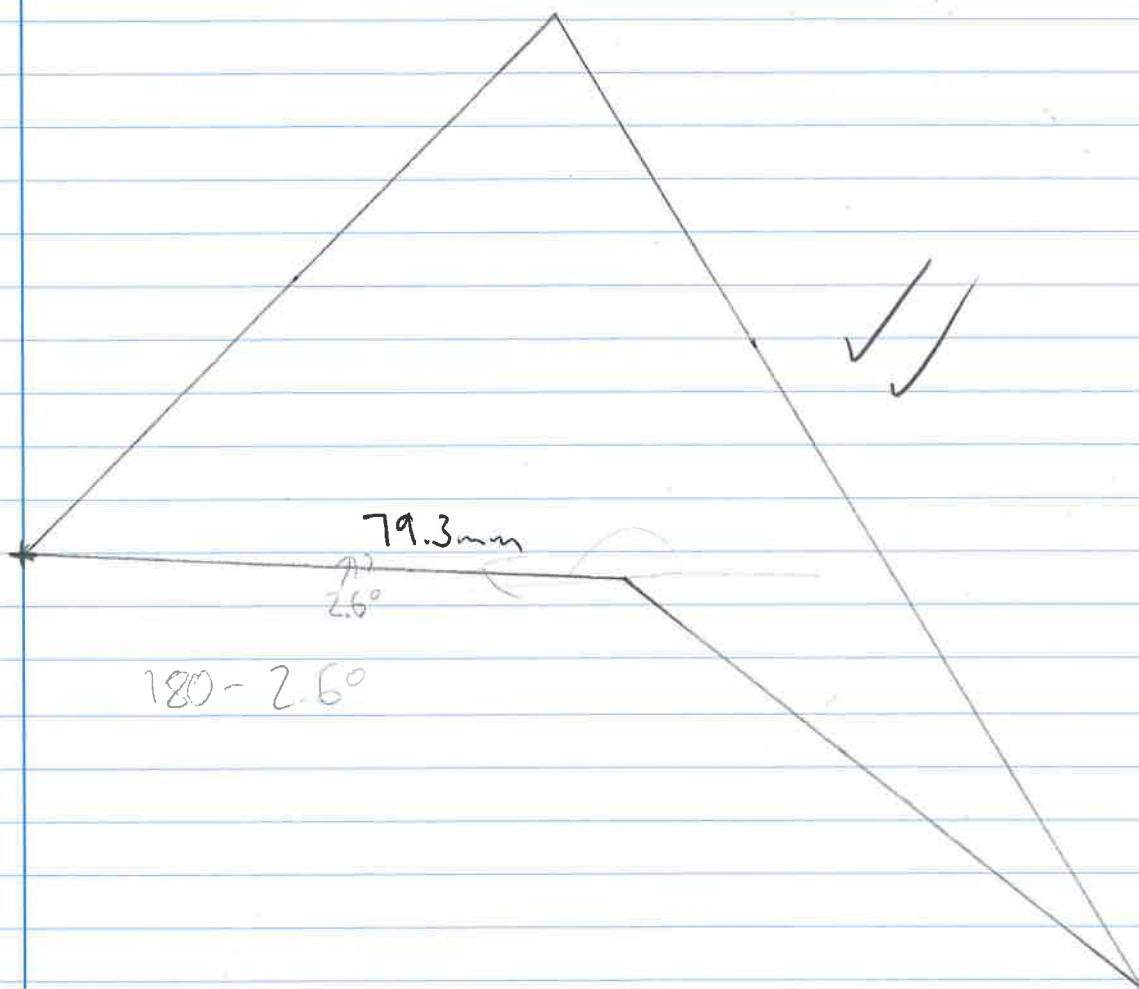
$$180 - 2.6 = \underline{177.4^\circ}$$

$$28M_d = 79.3$$

$$M_d = \underline{\underline{2.832 \text{ kg @ } 177.4^\circ}}$$

M- Polygon

scale 1mm = 1kgmm



5) $N_1 = 1500$ $T_1 = -15 \text{ Nm}$ $\eta = 0.85$ ✓

a) $GR = \frac{32}{20} \times \frac{36}{26} \times \frac{39}{16}$ ✓

$GR = 5.4$ ✓

$N_2 = \frac{N_1}{GR} = \frac{1500}{5.4}$

$N_2 = \underline{\underline{277.8 \text{ rpm}}} \text{ clockwise}$ ✓

b) $P_2 = ?$

$P_1 = \frac{T_1 \times 2\pi \times N_1}{60}$

$P_1 = \frac{15 \times 2\pi \times 1500}{60}$

$P_1 = \underline{\underline{2356.2 \text{ W}}}$ ✓

$P_2 = P_1 \eta$
 $= 2356.2 \times 0.85$

$P_2 = \underline{\underline{2002.8 \text{ W}}}$ ✓

c) $T_h = ?$

$T_2 = \frac{2\pi \times 277.8}{60 \times 2002.8} \times \frac{60 \times 2002.8}{2\pi \times 277.8}$

$T_2 = +68.85 \text{ Nm}$ ✓

$T_1 + T_2 + T_h = 0$

$T_h = 0 + 15 - 68.85$
 $= \underline{\underline{-53.85 \text{ Nm}}}$ ✓



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