



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: Atkinson

FORENAME(S): Deion Glyn

1	Student Number	1703067
2	Title of Examination Paper	Mechanical principles
3	Module Code	M5X02201
4	Date and Time of Examination	12:00 10/05/19
5	Examination Venue	310
6	Seat Number	G023
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	10
2	10
3	0
4	10
5	10
Total	40

$$\textcircled{1} P = 20000 \text{ W}$$

$$N = 4000 \text{ rpm}$$

$$\mu = 0.25$$

$$d_1 = 0.08 \text{ m} \rightarrow r = 0.04 \text{ m}$$

$$d_2 = 0.16 \text{ m} \rightarrow r = 0.08 \text{ m}$$

$$W = 600 \text{ N}$$

$$P = \frac{2\pi NT}{60}$$

$$T = \frac{P \times 60}{2\pi N}$$

$$T = \frac{20000 \times 60}{2 \times \pi \times 4000} = 47.75 \text{ Nm} \checkmark$$

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

$$\frac{T \times 3 \times (r_2^2 - r_1^2)}{4 \times \mu \times W \times (r_2^3 - r_1^3)}$$

$$n = \frac{47.75 \times 3 \times (0.08^2 - 0.04^2)}{4 \times 0.25 \times 600 \times (0.08^3 - 0.04^3)} \checkmark$$

$$n = 2.56, \text{ therefore 3 plates are required} \checkmark$$

$$F_2 = 139.179 \text{ N} \quad \checkmark$$

$$F_1 = 400 - 139.179$$

$$F_1 = 260.821 \text{ N} \quad \checkmark$$

$$c) P = v(F_1 - F_2)$$

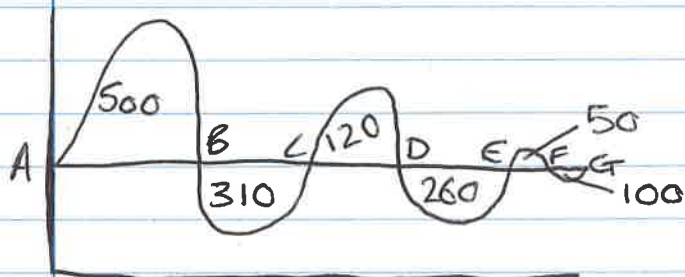
$$P = 21.886(260.821 - 139.179)$$

$$P = 2662.256 \text{ W} \quad \checkmark$$

$$d) \frac{7500}{2662.256} = 2.817, \text{ therefore 3 belts are needed} \quad \checkmark$$

$$\textcircled{4} \quad N_1 = 2250$$

$$N_2 = 2500$$



A	EA
B	EA + 500
C	EA + 500 - 310
D	EA + 500 - 310 + 120
E	EA + 500 - 310 + 120 - 260
F	EA + 500 - 310 + 120 - 260 + 50
G	EA + 500 - 310 + 120 - 260 + 50 - 100

EA
+500
+190 ✓
+310 ✓
+50
+100
0

$$BW = 500 - 50 = 450 \quad \checkmark$$

5) $N_1 = 1500 \text{ rpm}$ anticlockwise
 $N_2 = ?$
 $T_1 = 15 \text{ Nm}$ $T_2 = ?$
 $\eta = 0.85$ ✓

a) $GR = \frac{t_2}{t_1}$

$$GR = \frac{32}{20} \times \frac{36}{26} \times \frac{39}{16} \checkmark$$

$$GR = 5.4 \checkmark$$

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

$$N_2 = \frac{1500}{5.4} = 277.7 \text{ rpm in clockwise direction}$$

b) $P_i = \frac{2\pi N_1 T_1}{60}$

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

$$P_{in} = 2356.194 \text{ W} \checkmark$$

$$\eta = \frac{P_{out}}{P_{in}} \rightarrow 0.85 = \frac{P_{out}}{2356.194}$$

$$P_{out} = 0.85 \times 2356.194$$

$$P_{out} = 2002.765 \text{ W} \checkmark$$

③ $B = 0.02 \text{ m} / 5 \text{ kg}$
 $C = 0.05 \text{ m} / 3 \text{ kg}$

mr	
A	MA
B	0.1
C	0.15
D	MD

x x No table.



Question No.

Examiner Only



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