



12 Pages

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.**

(see note 2 below)

SURNAME: KRISHNA

FORENAME(S): SURIA

1	Student Number	1803204
2	Title of Examination Paper	VEHICLE DYNAMICS
3	Module Code	M5X00407
4	Date and Time of Examination	11/1/19 9:00 AM
5	Examination Venue	DYLAN THOMAS
6	Seat Number	G099
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1.	4
2.	3
	~~7~~
Office Use	11.7

1.

a) Mass = 1500 kgs

$\mu = 1.2$

Rolling Radius = 0.32 m

Moment of inertia = mass $\times$ (radius of gyration)²

$= 1500 \times (0.32)^2 = 154$

0/2

b)

$R_0 = 100 \text{ mm}$

$R_1 = 95 \text{ mm}$

$\alpha = 7^\circ$

$\mu = 0.2$

$T = 3000 \text{ Nm}$

diameters

Uniform pressure $\Rightarrow T = \frac{1}{\sin \alpha} \times \frac{2}{3} \times \mu \times F \times \frac{(r_0^3 - r_1^3)}{(r_0^2 - r_1^2)}$

$3000 = \frac{1}{\sin 7} \times \frac{2}{3} \times 0.2 \times F \times \frac{(100^3 - 95^3)}{(100^2 - 95^2)}$

$3000 = 8.21 \times 0.66 \times 0.2 \times F \times \frac{142625}{975}$

~~3000 = 8.21 \times 0.66 \times 0.2 \times F \times \frac{142625}{975}~~

$3000 = F \times 158.53$

$F = \frac{3000}{158.53} = 18.92 \text{ N}$

4/6

- d) Storage Capacity = 1 M Joule
 Max RPM = 10,000
 Max outer diameter = 0.5m

$$PE = m \cdot g \cdot h$$

$$10000 = m \times 9.81 \times 0.5$$

$$10000 = m \times 4.9$$

$$m = \frac{10000}{4.9}$$

$$m = 2040.82 \text{ Kg}$$

2. Width = 2m

Height = 3m

CD = 0.7

Density of air = 1.2 kg/m^3

Rolling resistance = 0.005 N

Operating speed = 40 Kph

Vehicle acceleration = 1 m/s^2

Vehicle deceleration with regenerative capacity = 1 m/s^2

Unladen weight = 5500 Kgs

Passenger capacity = 20 (one person + luggage = 100 Kgs)

Transmission efficiency = 80% in each direction

Distance between stations = 600m

- a) Total force required to accelerate the vehicle

~~Rolling resistance = $m \cdot g \cdot \text{coefficient of rolling resistance}$~~

Total mass = $5500 + (20 \times 100)$

= $5500 + 2000$

= 7500 Kgs ✓

$$\begin{aligned}\text{Rolling resistance} &= m \cdot g \cdot (\text{coefficient of rolling resistance}) \\ &= 7500 \times 9.81 \times 0.005 \\ &= \cancel{368} \text{ 368 N}\end{aligned}$$

$$\begin{aligned}\text{Accelerative resistance} &= m \cdot g \cdot (\text{rate of acceleration}) \\ &= 7500 \times 9.81 \times 1 \\ &= 73575 \text{ N}\end{aligned}$$

$$F = m \cdot a$$

$$\begin{aligned}\text{Total force required} &= \cancel{73575} \text{ N} + 368 \text{ N} + \text{Area} \\ &= 73943 \text{ N}\end{aligned}$$

3/4

b)

b)

c)

d)

e)

f)

g)

3

20

Question No.

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