

Name: Bonagura Pierluigi

Student number: 2005700

Module name: Automotive Chassis System

Module code: ACHA5013

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Bangwa P.uly

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Module name: ACMS013

Automotive Chassis

Student number: 2005300

QUESTION ONE

a) GEAR A - 24 teeth
B = 118 teeth
C = 32 teeth
D = 132 teeth
E = 12 teeth
F = 104

Gear ratio

$$\frac{B}{A} = \frac{118}{24} = 4.92$$

$$\frac{D}{C} = \frac{132}{32} = 4.125$$

$$\frac{F}{E} = \frac{104}{12} = 8.667$$

$$T_1 = 130 \text{ Nm}$$

$$\text{Total} = (4.92 \times 4.125 \times 8.667) = 175.90$$

$$b) N_2 = \frac{N_1}{175.90} = \frac{3000}{175.90} = 17.05 \text{ (anticlockwise)}$$

$$c) \text{Power input} = P_1 = 2\pi \times \frac{N_1 \times T_1}{60} = \frac{2\pi \times 3000 \times 130}{60} = 40840 \text{ W}$$

$$P_2 = P_1 \times \eta = 40840 \times 0.70 = 28588.4 \text{ W}$$

d) Calculate the holding torque

$$P_2 = \frac{2\pi \times N_2 \times T_2}{60} = \frac{P_2 \times 60}{2\pi \times N_2}$$

$$T_2 = \frac{(28588.49 \times 60)}{(2\pi \times 17.05)} = 16011.72 \text{ N/m (anticlockwise)}$$

$$T_1 + T_2 + T_3 =$$

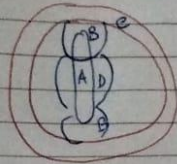
$$T_3 = -T_1 - T_2 = -130 + 16011.72 = 15881.72 \text{ N/m (clockwise)}$$

Bangor Pindig

2005+00

QUESTION ~~NUMBER~~

2]



Step	Action	A	B	e	D
1	resolve all by b	1	1	1	1
2	resolve D -1	0	$\frac{180}{32}$	$\frac{180}{60}$	-1
3	Add	1		1.63	0

Total from note = 1.1.63

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Bangladeshi Peeling

2005420

QUESTION 2

$$\begin{aligned} d_1 &= 0.105 \text{ m} & r_1 &= 0.0525 \text{ m} \\ d_2 &= 0.180 \text{ m} & r_2 &= 0.095 \text{ m} \\ \mu &= 0.32 \\ Q &= 6500 \text{ N} \end{aligned}$$

Uniform Pressure Theory

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

$$\frac{2}{3} \cdot 0.32 \cdot 6500 \times \frac{(0.095^3 - 0.0525^3)}{(0.095^2 - 0.0525^2)} =$$

$$\underline{157.64 \text{ N/m}}$$

Uniform wear theory

$$W = 6500 - (925 \times 1.2) = 5390 \text{ N}$$

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

$$0.32 \times \frac{5390 (0.095 + 0.0525)}{2} = \underline{153.4 \text{ N/m}}$$

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Boussinesq Piling

2005400

QUESTION TWO

$$d_1 = 0.060 \text{ m}$$

$$r_1 = 0.030 \text{ m}$$

$$d_2 = 0.115$$

$$r_2 = 0.0575 \text{ m}$$

$$\mu = 0.45$$

$$P = 450 \text{ kW}$$

$$T = 160 \text{ s}$$

$$W = 7000 \text{ N}$$

$$T = \frac{P \cdot 60}{2\pi \times N} = \frac{450000 \times 60}{2\pi \times 7500} =$$

$$m = ? \quad 7500 \text{ RPM}$$

$$572.96 \text{ N/m}$$

Uniform Wear theory

$$T = \frac{\mu W (r_2 + r_1) z(m)}{2}$$

$$z(m) = \frac{T \cdot 2}{\mu W (r_2 + r_1)} = \frac{(572.96 \times 2)}{0.45 \times 7000 (0.0575 + 0.030)} =$$

$$\frac{4.16}{2} = 2.08$$

$$m = 3 \text{ plates}$$

Uniform Pressure theory

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

$$z(m) = \frac{T \cdot 3}{2 \mu W} \cdot \frac{1}{(r_2^2 - r_1^2)} \cdot \frac{(r_2^3 - r_1^3)}{3}$$

$$572.96 \cdot \frac{3}{2} \cdot \frac{1}{0.45} \cdot \frac{1}{7000} \cdot \frac{(0.0575^3 - 0.030^3)}{(0.0575^2 - 0.030^2)} =$$

$$m = 3 \text{ plates}$$

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Perigee Pickup

2002000

0.00000-100

a) $d_o = 0.100 \text{ m}$
 $d_i = 0.055 \text{ m}$
 $R = 1200 \text{ N}$
 $\beta = 6^\circ$
 $\mu = 0.15$

Calculate the torque

Uniform Pressure theory

$$T = \frac{\mu R}{3 \sin \beta} \frac{[D_o^3 - D_i^3]}{[D_o^2 - D_i^2]}$$

$$\frac{0.15 \times 1200}{3 \sin(6^\circ)} \frac{[0.100^3 - 0.055^3]}{[0.100^2 - 0.055^2]} = 83.97 \text{ Nm}$$

Wear theory

$$T = \frac{\mu W (D_o + D_i)}{4 \sin \beta}$$

$$0.15 \times \frac{1200(0.100 + 0.055)}{4 \times \sin(6^\circ)} = 83.55 \text{ Nm}$$

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Bouqne Pieling

2005200

[QUESTION 3]

$$2) \quad LT_{long} = \frac{m \cdot e \cdot h}{w} = \frac{650 \times (9.81 \times 0.8) \times 0.31}{0.265} = 5967.44 \text{ N}$$

5)

$$m = 650 \text{ kg}$$

$$\text{Static load} = \frac{650 \times 0.45}{2} = 146.25 \text{ kg per wheel}$$

$$\text{Mass} = \frac{650 \times 0.55}{2} = 178.75 \text{ kg per wheel}$$

Dynamic load

$$\text{Front} = (146.25 \times 9.81) + \frac{5967.44}{2} = 4418.43$$

$$\text{Rear} = (178.75 \times 9.81) - \frac{5967.44}{2} = -1230.57$$

c) Approx 4500 N

$$\text{Total reaction force} = 18000 \text{ N}$$

$$d) F_w = 4500 \text{ N}$$

$$F_w = \frac{T}{R}$$

$$T = F_w \cdot R = 4500 \times 0.265 = 1192.5 \text{ N/m}$$

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Bourgeois Pierling

2005100

QUESTION 3

$$d) T = F_{\text{scyl}} \cdot u \cdot r$$

$$= \frac{T}{u \cdot r} = F_{\text{scyl}} = \frac{11925}{0.5 \times 0.165} = 14454.55 \text{ N}$$

$$F_{\text{scyl}} = P \times A_{\text{scyl}} \times m$$

$$\frac{F_s}{(A_{\text{scyl}} \times m)}$$

$$A_{\text{scyl}} = \left(\frac{0.045^2 \times \pi}{4} \right) =$$

↓

$$P = \frac{14454.55}{(1.53 \times 10^{-3} \times 4)} = \frac{0.00159043 \text{ m}^2}{2272727.98 \text{ N/m}^2}$$

$$P = \frac{F_{\text{scyl}}}{A_{\text{scyl}}}$$

$$A_{\text{scyl}} = \left(\frac{0.045^2 \times \pi}{4} \right) =$$

0.001651 m²

$$P \times A_{\text{scyl}} = F_{\text{scyl}}$$

$$2272727.987 \times 1.65 \times 10^{-4} = 375.00 \text{ N}$$

$$F_{\text{scyl}} = F_{\text{pedal}} \times PR$$

$$F_{\text{pedal}} = \frac{375}{4.2} = 89.29 \text{ N}$$

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Bourgeois Riding

2005100

QUESTION 4

2] Calculate the total traction resistance $v = 35 \text{ m/s}$

$$T_R = \frac{1}{2} \rho \cdot C_d \cdot A \cdot v^2 + m g (\sin \theta + C_r \cos \theta)$$

$$\frac{1}{2} \times 1.223 \times 0.36 \times 1.4 \times 35^2 + 1200 \times 9.81 \times (0.017)$$

$$377.54 + 200.12 = 577.66 \text{ N}$$

b] $m_s = 0.8$ $v = 70 \text{ m/s}$ $N = 6500$

$$v = \frac{2\pi \cdot R \cdot N}{60 f m_s}$$

$$f = \frac{2\pi \cdot R \cdot N}{60 \times v \times m_s} = \frac{2\pi \times 0.28 \times 6500}{60 \times (70 \times) (0.8)} = 3.40$$

c] $\theta = \tan^{-1}\left(\frac{1}{3}\right) = 18.44^\circ$

$$T_R = m g (\sin \theta + C_r \cos \theta)$$

$$1200 \times 9.81 \times (\sin 18.44 + 0.017 \cos 18.44) =$$

$$3913.47 \text{ N}$$

$$m_1 = \frac{T_R \times R}{T \times f_1} = \frac{3913.47 \times 0.28}{200 \times 3.40 \times 0.8} = 2.01$$

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Bouguine Pilling

"QUESTION 4"

20-5-100

$$d) \quad SR = \frac{5200}{6500} = 0.8$$

$$M_L = 2.01 \times 0.8 = 1.608$$

$$M_3 = 2.01 \times 0.8^2 = 1.2864$$

$$M_4 = 2.01 \times 0.8^3 = 1.02912$$

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