



PROGRAM : NATIONAL DIPLOMA
ENGINEERING : MECHANICAL & INDUSTRIAL

SUBJECT : **MECHANICS I**

CODE : **CHM 1111 (EXTENDED)**

DATE : NOVEMBER EXAMINATION
18 NOVEMBER 2014

DURATION : (SESSION 1) 08:30 - 11:30

WEIGHT : 40 : 60

TOTAL MARKS : 119

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MODERATOR : MS A MAMBA 2127

NUMBER OF PAGES : 7 PAGES INCLUDING THE HEADER

INSTRUCTIONS TO STUDENTS

- ANSWER ALL QUESTIONS. ANSWERS WITHOUT UNITS WILL BE PENALISED.
 - A STUDENT IS EXPECTED TO MAKE REASONABLE ASSUMPTIONS FOR DATA NOT SUPPLIED.
 - NUMBER YOUR QUESTIONS CLEARLY AND UNDERLINE THE FINAL ANSWER.
 - ALL DIMENSIONS ON DIAGRAMS ARE IN mm UNLESS OTHERWISE SPECIFIED.
 - GRAVITY = $9,81 \text{ m/s}^2$
-

QUESTION 1

A motor Mechanic is lifting an engine from a 2008 Ford Bantam. He wants to overhaul it (remove pistons and the crank shaft). In order to suspend the engine, he has anchored two poles in the ground, one pole across the top of the two poles, a chain is hooked to the horizontal pole and to the engine, as shown in figure 1 below.

- 1.1 Draw a diagram that is showing all the forces that are acting on the chain; (3)
- 1.2 By resolving forces into components, calculate the tension in the chain, while the 500 kg engine is suspended in the air. (15)

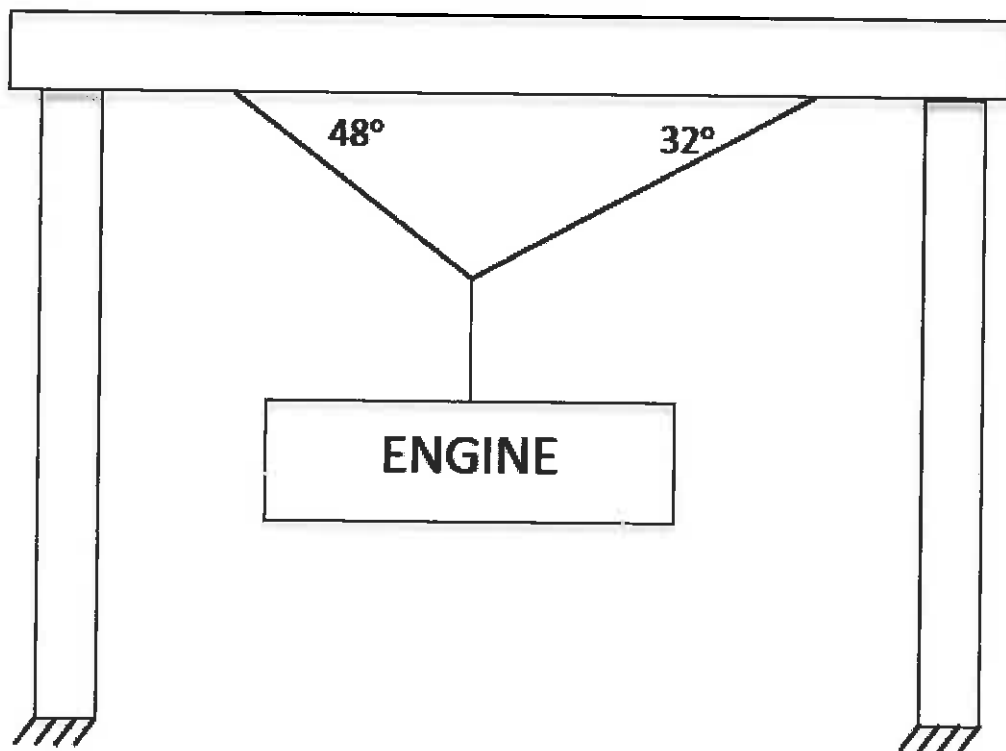


Figure 1

[18]

QUESTION 2

Figure 2 below shows a lever ABC hinged at C with three cables attached which pull on it with forces of 50 N, 200 N and P in the directions shown. AB is 400 mm and BC is 1,2 m. The lever ABC has a weight of 30 N.

2.1 Calculate the magnitude of force P so that the lever will be in static equilibrium: (8)

2.2 Determine the magnitude and direction of the reaction at the hinge. (8)

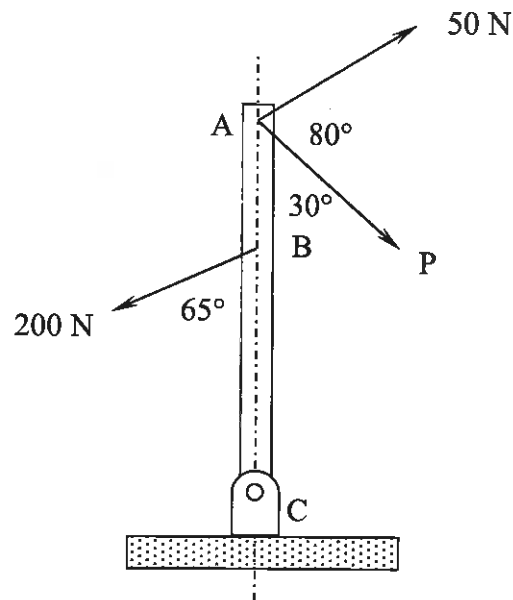


Figure 2

[16]

QUESTION 5

Doornfontein Train Station is 4 km from Park Station. A train from Germiston arrives at Doornfontein station and stops. It then departs and accelerates until it reaches a speed of 72 km/h. It maintains this speed for a while and then starts to decelerate and stops at Park Station. The journey from Doornfontein Station to Park Station takes 5 minutes. The magnitude of the acceleration is half the magnitude of deceleration.

- 5.1 Draw the time-velocity graph for this journey and include all important information; (4)
- 5.2 Find the magnitude of acceleration; (13)
- 5.3 What is the distance that has been travelled at constant speed? (2)

[19]

QUESTION 6

A water pump is driven by a belt passing around a 200 mm diameter pulley. The pulley is rotating at 3000 rev/min and is brought to rest in 210 revolutions with uniform retardation.

- 6.1 Determine the linear deceleration of the pulley belt assuming no slip. (9)
- 6.2 Also calculate the number of revolutions turned by the water pump shaft during the first 3 seconds. (6)

[15]

QUESTION 7

A truck of mass 6 tonnes has a tractive resistance of 0,7% of its weight. The truck reaches a speed of 90 km/hr from rest in a distance of 620 m down a slope of 1 in 300. Assuming uniform acceleration, use the principle of conservation of energy to calculate the required tractive effort from the engine.

(8)

[8]

QUESTION 8

On the 20th of September 2014, at 8pm, Kaizer Chiefs and Orlando Pirates were playing finals for the MTN Wafa-wafa competition. At the beginning of the match, the match officials and the captains of the two teams were seen standing in the centre of the Moses Mabhida Stadium in Durban. One of the officials was flipping a coin to decide the direction of play of these two giant teams.

Let us analyse the coin:

If the coin has an initial velocity vertically upwards of 2 m/s and it leaves his hand 1,2 m above the ground, calculate:

- 8.1 the velocity of the coin as it hits the ground; (3)
- 8.2 the time the coin takes to reach the ground; (2)
- 8.3 the maximum height reached by the coin; (2)
- 8.4 the time taken to reach the maximum height; (2)
- 8.5 the velocity of the coin as it falls past the official's hand. (2)

[11]

TOTAL = 119
