UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA ENGINEERING: MECHANICAL ENGINEERING: INDUSTRIAL
SUBJECT	:	**MECHANICS I**
CODE	:	**CHM 111T**
DATE	:	SUMMER EXAMINATION 2015 24 NOVEMBER 2015
DURATION	:	(SESSION 1) 08:30 - 11:30
WEIGHT	:	40 : 60
TOTAL MARKS	:	106 100 MARKS = 100%
EXAMINER	:	MR S GQIBANI
MODERATOR	:	MRS A MAMBA
NUMBER OF PAGES	:	6 PAGES

INSTRUCTIONS

: ANSWER ALL THE QUESTIONS.
: ALL DIMENSIONS ON DIAGRAMS ARE IN mm UNLESS OTHERWISE SPECIFIED.
: ONLY NEAT SKETCHES OF A SUITABLE SIZE WILL BE GIVEN CREDIT.
: ONE CALCULATOR PER CANDIDATE.

2/...

QUESTION 1

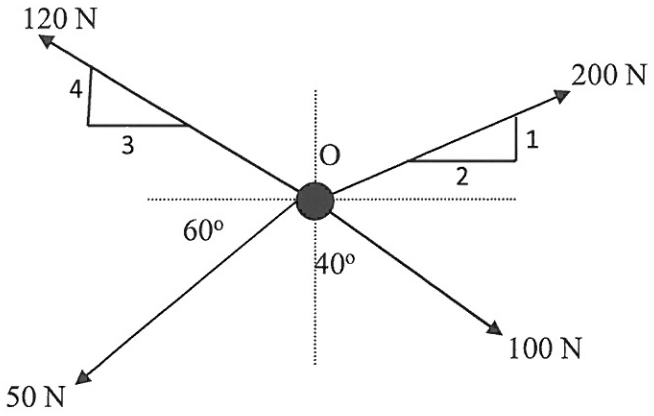

Figure 1

A system of four forces acting on a body is shown in Figure 1. Note that the direction of forces 120 N and 200 N is given in terms of the gradient.

1.1 Calculate the direction of the forces 120N and 200N in degrees;

1.2 Determine the resultant force of the four forces and its direction.

1.3 What is the value of the equilibrant force and its direction?

1.4 Show the resultant and equilibrant forces on your diagram that is showing the forces.

[17]

QUESTION 2

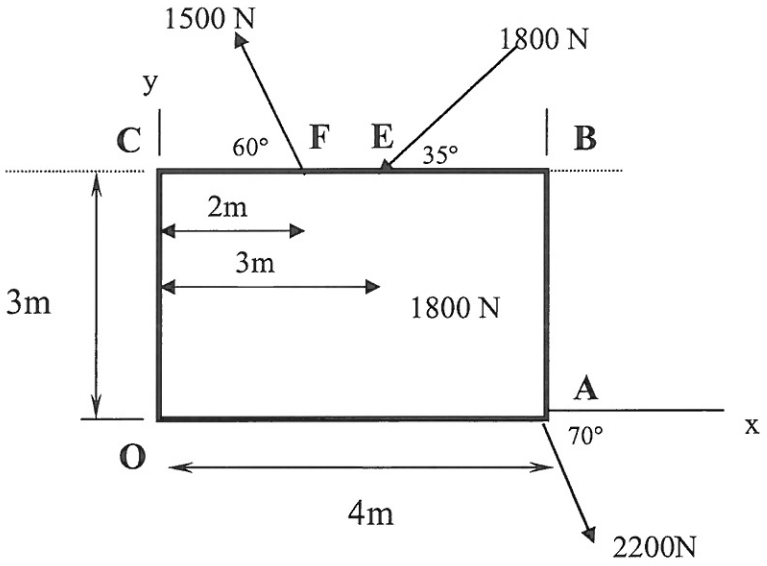

Figure 2

Figure 2 shows a coplanar system of forces acting on a flat plate. Ignore the weight of the flat plate and calculate:

2.1 The resultant force and its direction;

2.2 The position of the resultant force measured from corner C.

2.3 show the resultant force on your sketch.

[16]

QUESTION 3

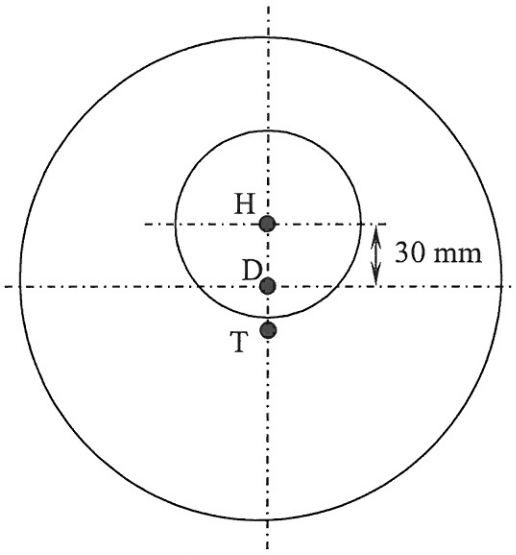

Figure 3

A disc of ϕ 260 mm has a hole of ϕ 100 mm cut in it as shown in Figure 3, find the position of the centroid for the composite figure, and show the position on the diagram.

[10]

QUESTION 4

A block that has a mass of 100 kg rests on an inclined plane which forms an angle of 15° to the horizontal. Calculate the force, which is acting at an angle of 20° to the inclined plane which will pull the block up the incline which will:

4.1 pull the body up the incline; (7)

4.2 push the body up the incline. (5)

[12]

QUESTION 5

Mr Baloyi is driving his Ford Ranger along Beit Street. He starts the bakkie from rest with a uniform acceleration until a velocity of 48 km/h is reached. The Ford Ranger then moves with a constant speed until Mr Baloyi decelerates and finally stops the bakkie 600 m from the starting point. The whole journey takes 1 minute and the magnitude of his deceleration is twice that of the acceleration.

5.1 Draw the velocity – time graph for the complete journey and show all the important information. (3)

5.2 find the magnitude of acceleration; (14)

5.3 also calculate the distance the bakkie travelled with constant velocity. (2)

[19]

QUESTION 6

A body is released from rest from a building 110 m high and at the same time a second ball is projected upwards from the ground at 60 m/s:

6.1 calculate the time taken for the two bodies to reach other; (5)

6.2 how high above the ground will the bodies pass each other. (2)

[7]

QUESTION 7

A flat belt is used to connect a large pulley which is 800 mm in diameter, this pulley is driving a 200 mm diameter pulley. The bigger pulley is accelerated from 60 r/min to 240 r/min during which it turns through 360 revolutions. Assuming that there is no belt slip, calculate:

7.1 the angular acceleration of each pulley in rad/s^2; (5)

7.2 the linear acceleration of the flat belt; (2)

7.3 the initial and final velocity of the smaller pulley in r/min and rad/s respectively. (4)

[11]

QUESTION 8

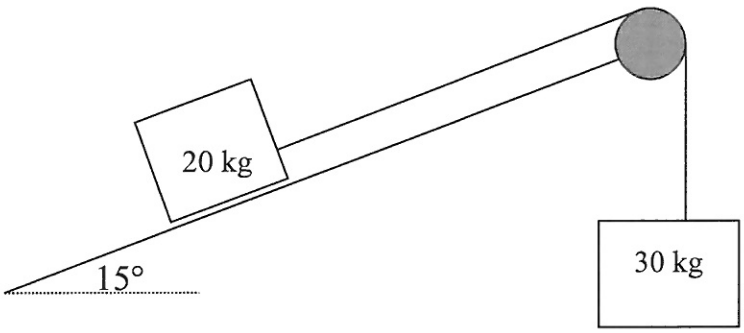

Figure 4

8.1 List the SEVEN different forms of energy that are associated with bodies in motion. (7)

8.2 A 20 kg mass is attached to a 30 kg mass by a light cord passing over a light, frictionless pulley as show in figure 4. The coefficient of friction on the 15° incline is 0,15. Calculate:

8.2.1 the direction of motion of the system when the masses are released; (3)

8.2.2 the acceleration of the masses. (4)

[14]