UNIVERSITY
OF
JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: MECHANICAL and INDUSTRIAL*
SUBJECT	:	**MECHANICS 1**
CODE	:	**CHM1111**
DATE	:	**WINTER EXAMINATION 2016** 02 JUNE 2016
DURATION	:	(SESSION 3) 16:30 - 19:30
WEITHT	:	40 : 60
TOTAL MARKS	:	101 [100 marks = 100%]

EXAMINER	:	MR S.L. GQIBANI
MODERATOR	:	DR M. MASHININI
NUMBER OF PAGES	:	4 PAGES

INSTRUCTIONS TO CANDIDATES:

- PLEASE ANSWER ALL QUESTIONS.
- NUMBER ALL YOUR QUESTIONS CLEARLY AND UNDERLINE YOUR FINAL ANSWERS.
- SHOW ALL THE CALCULATIONS.
- ALL ANSWERS, BOTH INTERMEDIATE AND FINAL MUST HAVE THE CORRECT UNITS, ANSWERS WITHOUT UNITS WILL NOT BE CONSIDERED.
- NO MARKS WILL BE GIVEN TO ILLEGIBLE WORK.
- ALL SKETCHES MUST BE LARGE AND CLEAR

QUESTION 1

A system of four forces acting on a body is shown in Figure 1. Using the algebraic method, find the resultant force and its direction.

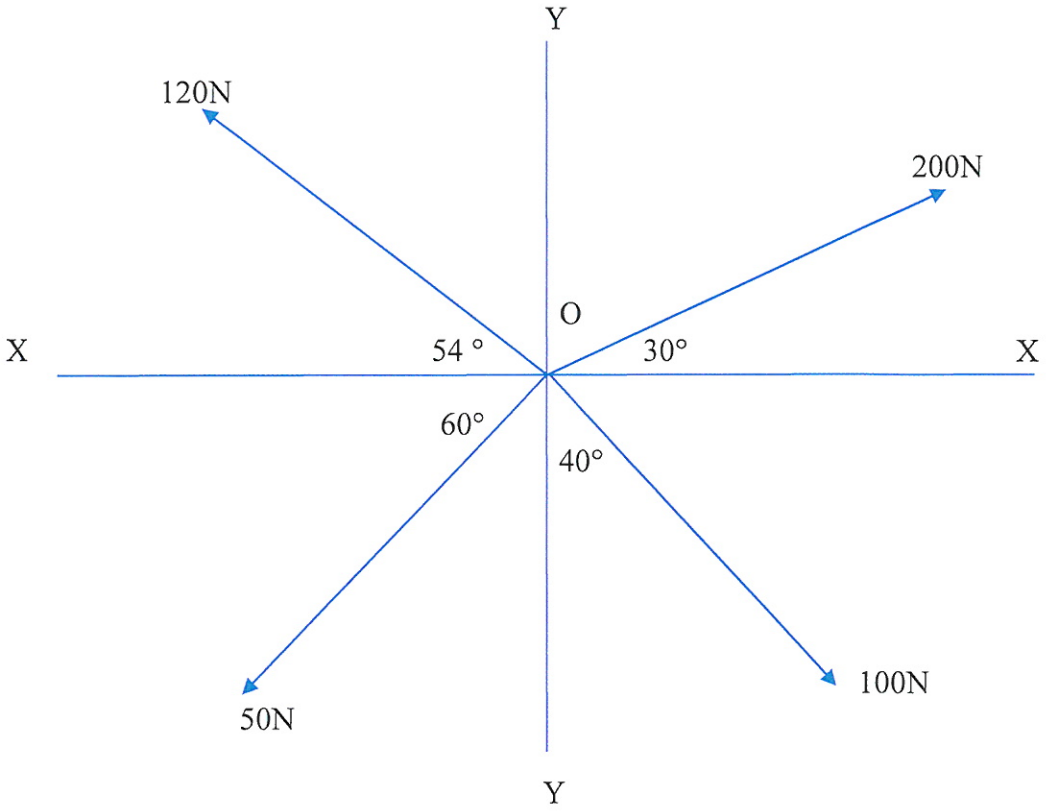

FIGURE 1

[13]

QUESTION 2

The sketch 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. Calculate the magnitude of force P so that the lever will be in static equilibrium and then determine the magnitude and direction of the reaction at the hinge.

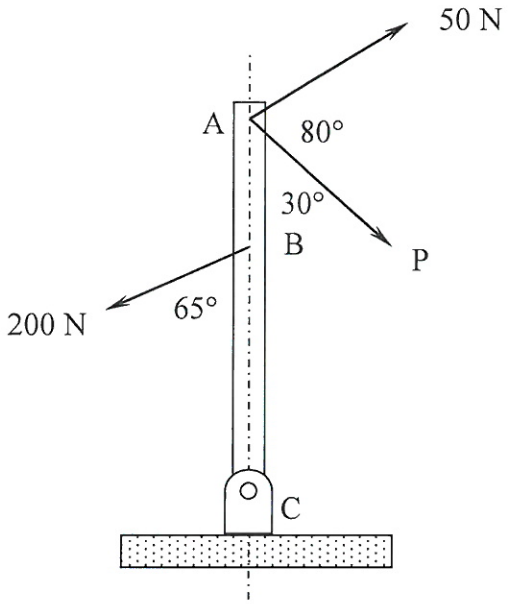

Figure 2

[14]

QUESTION 3

A uniform beam that is 3,6m long is loaded as shown below. The mass of the beam is 300kg. Calculate the reactions of the supports.

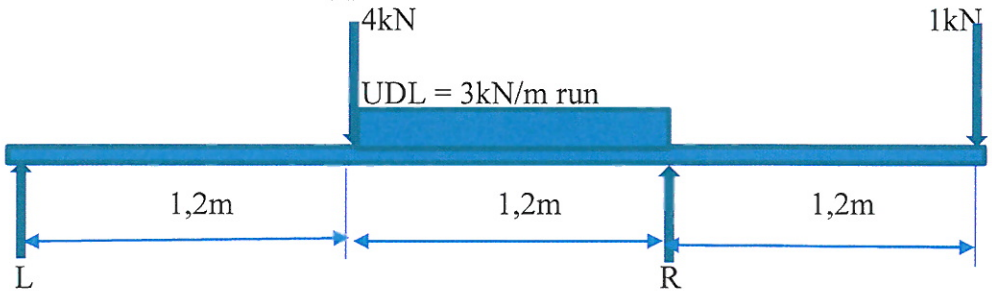

Figure 3

[10]

QUESTION 4

Determine the position of the centre of gravity of the composite object shown. Use the axis directions as they appear on the drawing and use corner P as your reference. All dimensions are in mm.

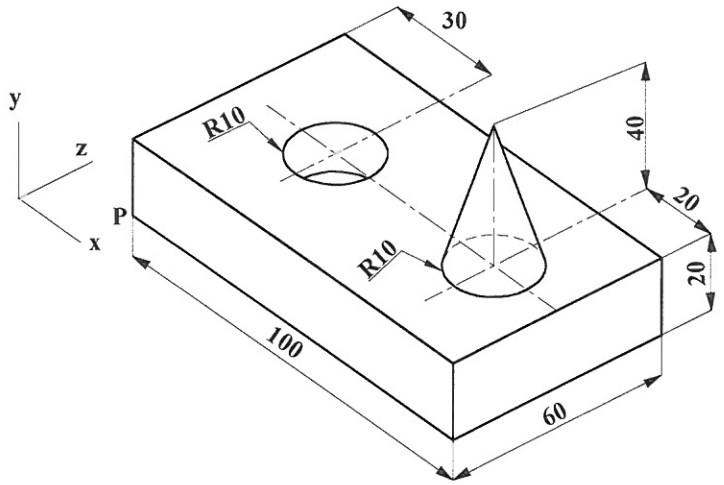

Figure 4

[14]

QUESTION 5

Find the force needed to start the 200 N weight moving to the right, if the coefficient of friction on all friction surfaces is 0,35.

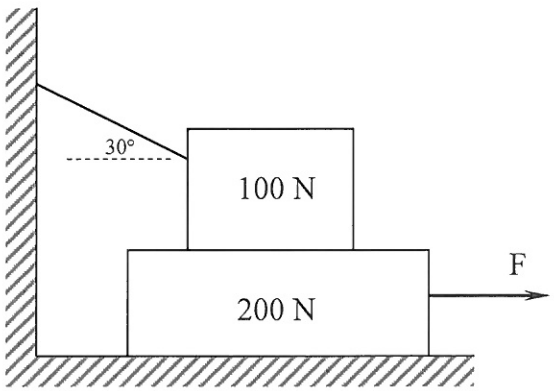

Figure 5

[10]

QUESTION 6

A Ferrari owner is driving his car along the N1 from Bloemfontein to Johannesburg. He spots a traffic officer while his car was cruising at 150km/h. He applies brakes over a distance of 160m, and the speed drops to 90km/h.

6.1 What is his acceleration (assuming that it is constant)? (5)

6.2 How long does it take him to slow down? (2)

6.3 If he continues to slow down with the acceleration in 6.1, how long will it take him to come to a complete halt? (2)

6.4 What distance would you cover in 6.3? (2)

6.5 Assuming that his initial speed was halved (75km/h), would it take him half the time to a complete halt? (3)

[14]

QUESTION 7

The front and back wheels of a racing car have effective diameters of 600 mm and 720 mm respectively. The car moves with uniform acceleration from 180 km/h to 252 km/h over a distance of 500 m. Calculate:

7.1 the linear acceleration of the racing car and the angular acceleration of each wheel set. (8)

7.2 the number of revolutions completed by each set of wheels during acceleration. (8)

7.3 the final angular velocity, in rad/s and r/min, respectively, of each wheel set.(4)

[20]

QUESTION 8

A truck of mass 3 tonnes accelerates uniformly from rest to 72 km/h in 30 seconds down an incline of 1 in 120. The tractive resistance is constant at 400 N. Use the principle of conservation of energy to calculate the tractive effort required from the engine.

[6]

FULL MARKS: 100
TOTAL MARKS :101