UNIVERSITY OF JOHANNESBURG

PROGRAM	:	NATIONAL DIPLOMA *ENGINEERING: MECHANICAL (EXT)* *ENGINEERING: INDUSTRIAL (EXT)*
SUBJECT	:	**MECHANICS I**
CODE	:	**CHM111T**
DATE	:	SUPPLEMENTARY EXAMINATION 12 JANUARY 2017
~~**DURATION**~~	:	~~150h00 – 18h00~~
WEIGHT	:	40 : 60
TOTAL MARKS	:	100

EXAMINER	:	MR T.A. BALOYI
MODERATOR	:	MR S.L. GQIBANI
NUMBER OF PAGES	:	5 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

Calculate the magnitude and direction of the reaction at the pivot P of the lever shown in figure 1 below.

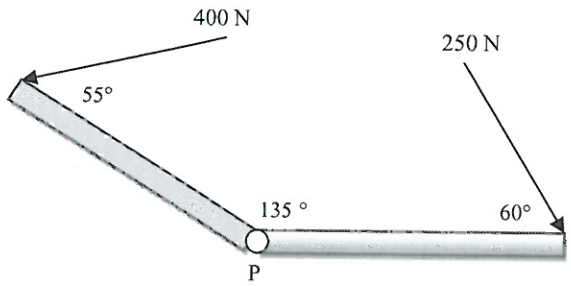

Figure 1

[12]

QUESTION 2

Figure 2 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 0.4m and BC is 1,2 m. The lever ABC has a weight of 30 N. Calculate

2.1 the magnitude of force P so that the lever will be in static equilibrium; (7)

2.2 the magnitude and direction of the reaction at the hinge. (5)

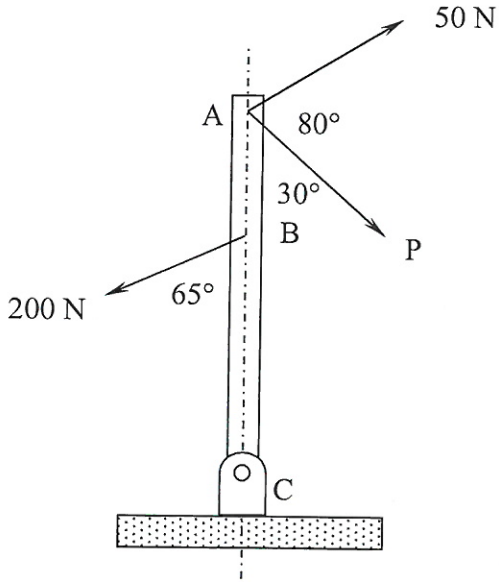

Figure 2

[12]

QUESTION 3

The stepped machine component shown in figure 3 is made from two different materials. The step with the larger diameter has a density twice that of the density of the smaller section. Each step has a hole of diameter 30 mm and depth 40 mm drilled into it.

Calculate the position of the $\bar{x}$ measured from the right hand end.

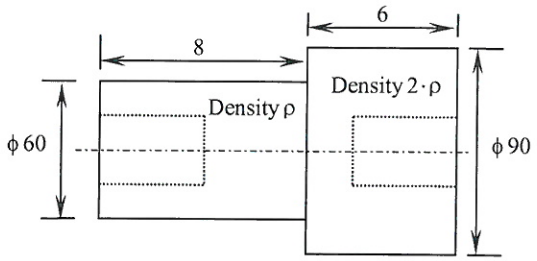

Figure 3

[10]

QUESTION 4

Calculate the magnitude of the smallest weight W necessary for the 100 N block to start sliding.

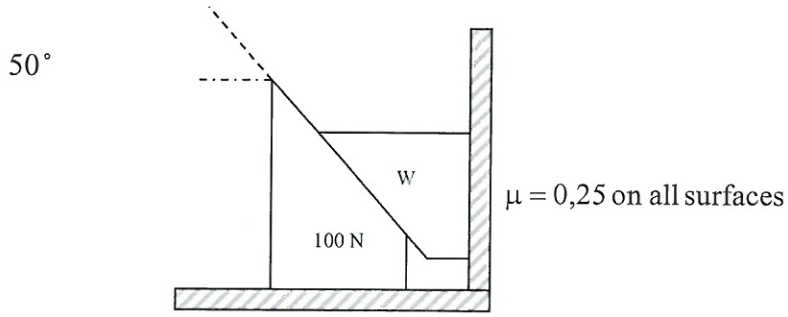

Figure 4

[12]

QUESTION 5

5.1. An endless belt 5 m long passes over a pulley of 500 mm diameter making 150 rev/minute. The pulley accelerates to 250 rev/minute in 25 seconds. If there is no belt slip, calculate:

5.1.1 the linear acceleration of the belt; (4)

5.1.2 the number of revolutions made by the pulley during the first 10 seconds; (3)

5.1.3 the number of times a point on the belt will pass over the pulley in 15 s. (3)

5.2. A flywheel is accelerated uniformly from rest to 2000 r/min in two minutes. Calculate

5.2.1 its angular acceleration and; (2)

5.2.2 the number of revolutions it turns in the first ninety seconds. (2)

[14]

QUESTION 6

A flywheel starts from rest and accelerates uniformly at 2 rad/sec^2 until it reaches a speed of 500 r/min. It maintains this speed for a certain period after which it comes to rest with a constant deceleration of 5 rad/sec^2. If a total of 600 revolutions were made by the flywheel.

6.1 Draw an angular velocity–time graph (3)

6.2 Use the velocity-time graph to determine the total time taken from start to stop (9)

[12]

QUESTION 7

A shaft has a diameter of 100 mm and rests between two bearings 1m "metre" apart. The shaft carries a load of 75 kN acting between the bearings and 250 mm from one of them. The coefficient of friction is 0,03 in the bearing nearest the load and 0,04 in the other. Calculate the power required to overcome friction at 200 rev/min

[10]

QUESTION 8

A spring of stiffness 2 kN/m is compressed 60 mm and held in position while a mass of 70 g is placed on it. The spring is then pointed upwards and released. Use Newton's second law to calculate the maximum height reached by the mass.

[8]

QUESTION 9

The diagram shows a 200 kg mass attached to a 25 kg mass by a light cord passing over a light, frictionless pulley. If the coefficient of friction, $\mu = 0.33$ on the inclined plane, use the principle of conservation of energy to determine the acceleration of the system when the masses are released.

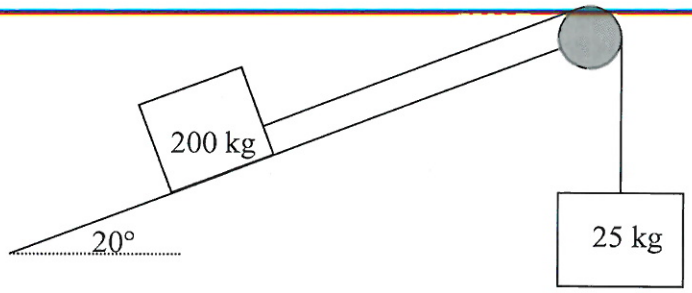

Figure 5 **[10]**