GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY
Faculty of Engineering
Department of Mechanical Engineering

BSc Engineering Degree
Semester 2 Examination – March/ April 2022
(Intake 38- ENG)

ME 1222- APPLIED MECHANICS

Time allowed: 2 hours 07 April. 2022

ADDITIONAL MATERIAL PROVIDED

INSTRUCTIONS TO CANDIDATES

This paper contains 5 questions on 6 pages

Answer ALL questions

This is a closed book examination

This examination accounts for 70% of the module assessment. A total maximum mark obtainable is 100. The marks assigned for each question and parts thereof are indicated in square brackets

If you have any doubt as to the interpretation of the wordings of a question, make your own decision, but clearly state it on the script

Assume reasonable values for any data not given in or provided with the question paper, clearly make such assumptions made in the script

All examinations are conducted under the rules and regulations of the KDU

Question 01

(a) By using a neat sketch state the Triangle rule and application of cosine law for vector addition

(06 Marks)

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(b) Four forces are acted upon at point A as per given in Figure 1.

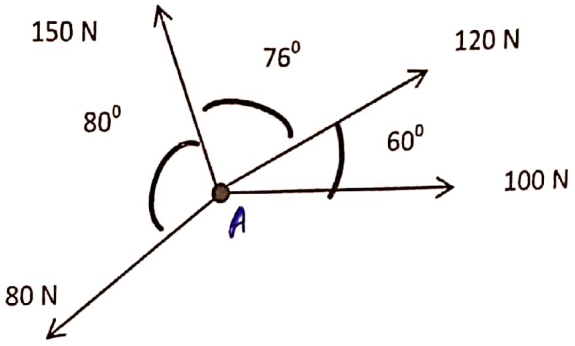

Figure 1

i. Draw the vector polygon for the force system **(04 Marks)**

ii. Calculate the resultant force through repeated application of the triangle rule **(06 Marks)**

iii. Assume the resultant force (R) is acted on a rectangular body at point A as in figure 2. Determine the equivalent force couple system at point B. **(04 Marks)**

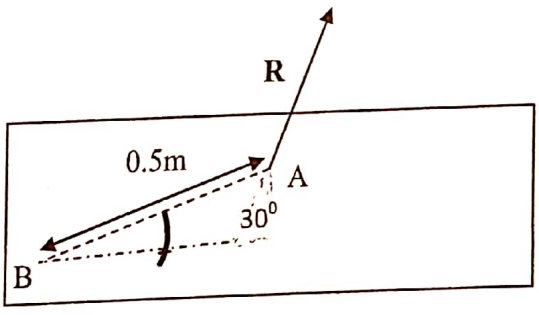

Figure 2

Question 02

A thin weightless rectangular plate is attached to a wall at C by using a pin and bracket. The pin joint allows it to rotate about F-F_0 axis. As shown in figure 3 the plate is kept perpendicular to the wall by using two cables AE and BD. The plate is supported by a pin and bracket at C so that the plate can rotate around F-F_0 axis. A weight of 500 N is placed on the plate at point G. If tension of the cable BD is 200 N, determine the tension of the cable AE and reaction at C.

(20 Marks)

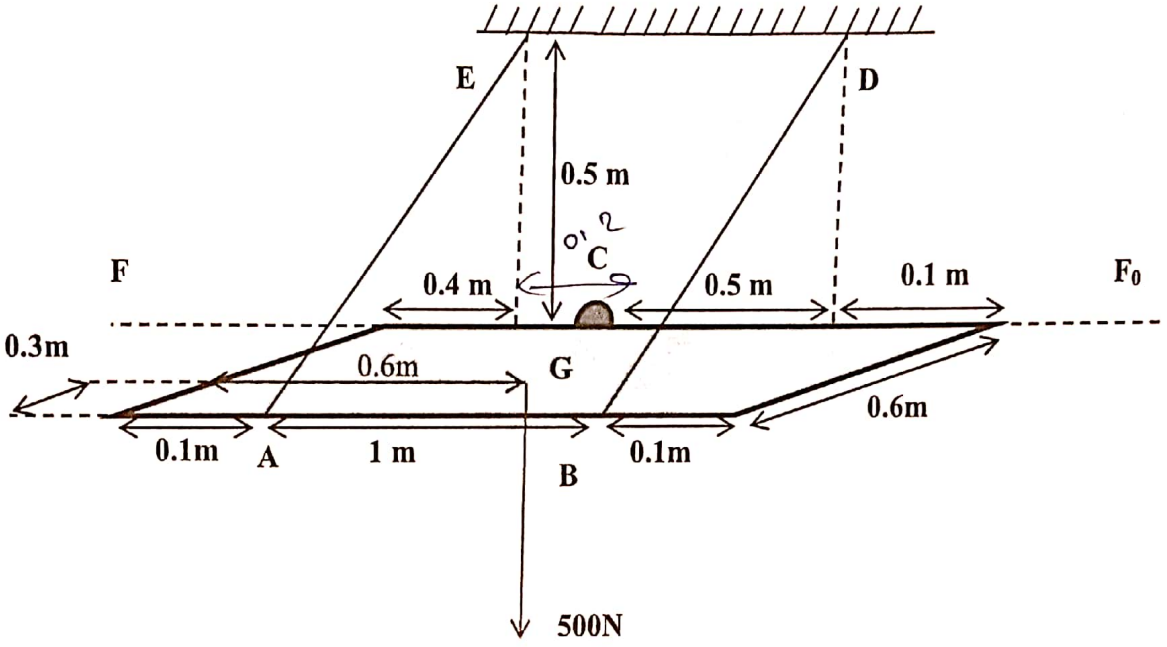

Figure 3

Question 03

Three blocks A,B and C having masses of 177 g, 125 g and 500 g respectively are placed on a rough belt which is inclined 30^0 to the horizontal plane. The packages are placed on the belt so that they are in contact with each other and at rest. Blocks A and B have static friction coefficients of 0.1 and 0.2 respectively.

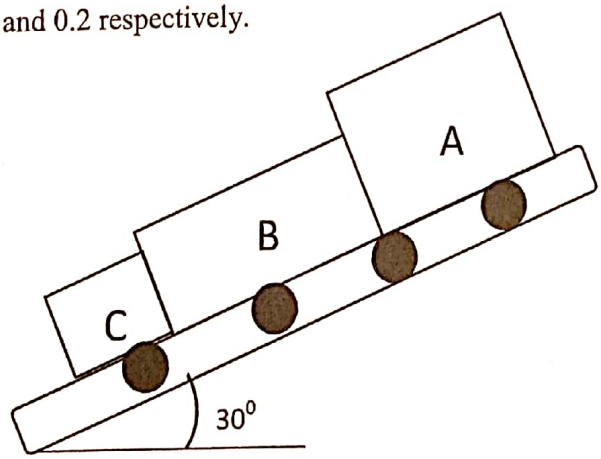

Figure 4

(a) If the system of three blocks are at impending motion, show that:

$$F_A + F_B + F_C = (W_A + W_B + W_C)\,\mathrm{Sin}\,30^0$$ **(10 Marks)**

F_A, F_B and F_C = *Friction forces of blocks A, B and C*

W_A, W_B and W_C = *Weights of blocks A, B and C*

(b) Determine the minimum value of static friction coefficient of block C for the system to be stable. **(05 Marks)**

(c) Determine the angle of the belt if the three blocks to be at rest without touching each other. **(05 Marks)**

Question 04

(a) A 200 g mass is attached to 109 cm string hanging from the ceiling. The mass is released when the string makes exactly 4.6^0 from the verticle.

i. Calculate the period of the motion, **(05 Marks)**

ii. Write expressions for angular displacement and angular velocity using standard model (disregard the correction factor and assume that the mass underegoes simple harmonic motion). **(10 Marks)**

iii. Calculate the maximum velocity of the mass and the time which it occurs. **(05 Marks)**

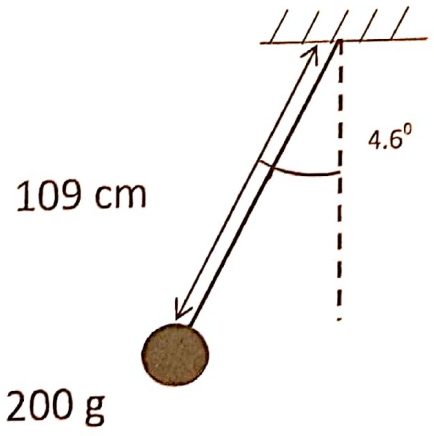

Figure 5

Question 05

(a) State the Pappus Goldinus theorem. **(04 Marks)**

(b) Find the centroid of the shaded area using integration. **(10 Marks)**

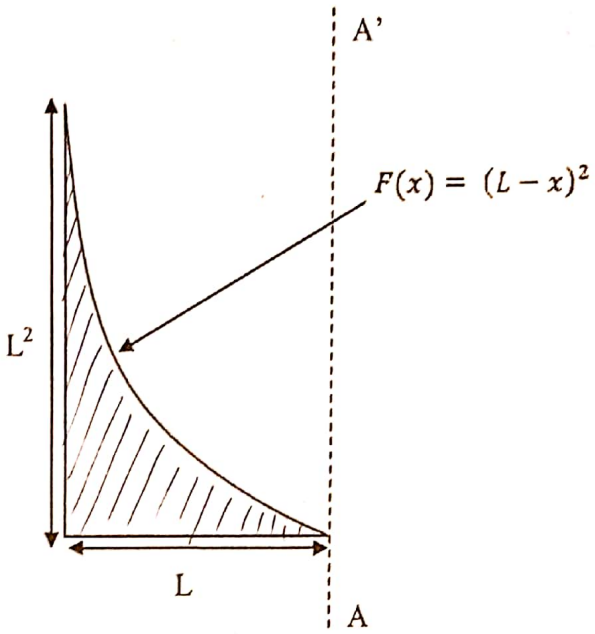

Figure 6

(c) A glass ornament having a cylindrical shape along with a parabolic cavity is planned to fabricate. The exact shape could be achieved through rotating above shape around **A-A'** axis. Calculate the location of centre of gravity of the object from its bottom. **(06 Marks)**

Note: If volume of a baraboloid of a revolution of base radius of 'a' and height 'h' is 'v' and centre of gravity from the base is '$\bar{y}$'.

$$v = \frac{\pi}{2} a^2 h$$

$\bar{y} = h/3$

End of question paper