UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION, FIRST SEMESTER DECEMBER 2012

TITLE OF PAPER:	**ENGINEERING MECHANICS AND MATERIALS SCIENCE**
COURSE CODE:	**EE201**
TIME ALLOWED:	**THREE HOURS**

INSTRUCTIONS:

1. Answer any **four (4) questions**
2. Each question carries 25 marks.
3. Marks for different sections are shown in the right-hand margin.

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

This paper has 4 pages including this page.

Question 1

Determine the reactions (R_A and R_B) and the stresses in members AB, EB, and BD of the roof truss shown in Figure 1. (25 marks)

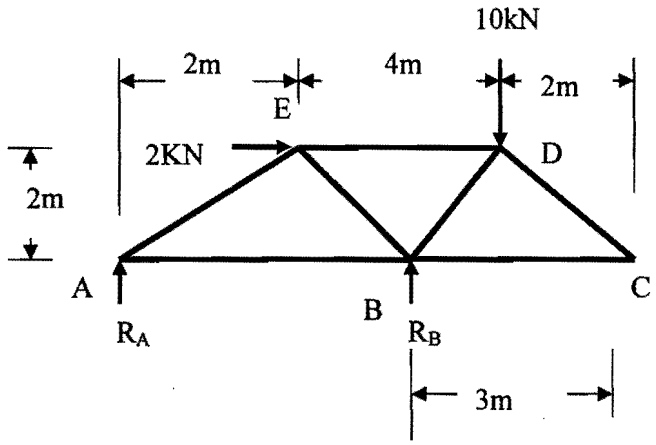

Figure 1

Question 2

Figure 2 shows masses on two rotors in planes B and C. Determine the masses (M_A and M_D) and angles (θ_A and θ_B) at which the masses (M_A and M_D) are to be added on the rotors in planes A and D at radius 45mm which will produce static and dynamic balance.

(25 marks)

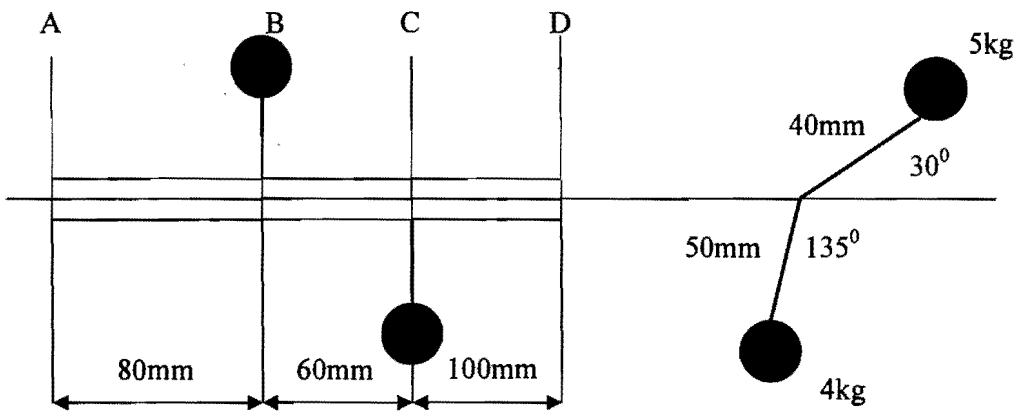

Figure 2

Question 3

If the solid cylinder shown in Figure 3 weighs 2kN, its radius r is 60 cm, and its centroidal moment of inertia I_C is 500m.N.sec^2. It rolls without slipping down the incline. Assume rolling friction to be negligible and g = 9.81m/s. At time t = 1 second and by using impulse-momentum method, calculate:

a) the linear velocity $\bar{v}$ of its center of gravity and
b) the minimum coefficient of static friction μ required to prevent slipping.

(25 marks)

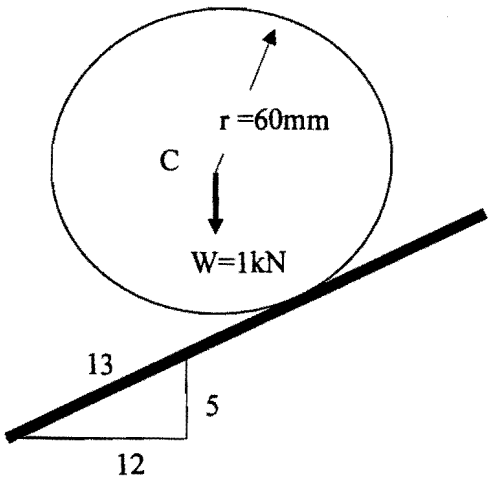

Figure 3

Question 4

a) List the uses of the following types of copper and its alloys:

i) Phosphorus deoxidized arsenical copper (3 marks)

ii) High-tensile brass (8 marks)

iii) Gunmetal (4 marks)

b) List the uses of Nylon in light engineering components the uses pertaining to it being non-toxic. (10 marks)

Question 5

Define the following properties of raw materials required for forming processes and for each property state the process or processes in which the property is required.

i) Fluidity, (5 marks)

ii) Ductility, (5 marks)

iii) Malleability, (5 marks)

iv) Plasticity, and (5 marks)

v) Toughness. (5 marks)