Federal University of Technology, Owerri

Department of Building Technology, SOET

Harmattan Semester Examination 2013/2014 session

Course Title: Structural Mechanics I (BDT 213)
Instructions: Answer any Five Questions Time: 3 hrs

1(a) Discuss dimensional analysis as used in engineering calculations. *(4mks)*

(b) Name the four basic forms of stress *(4mks)*

(c) Explain the terms 'strength', 'rigidity' and 'ductility' as used in engineering mechanics. *(6mks)*

(d) Distinguish between the following

i. Pressure and stress

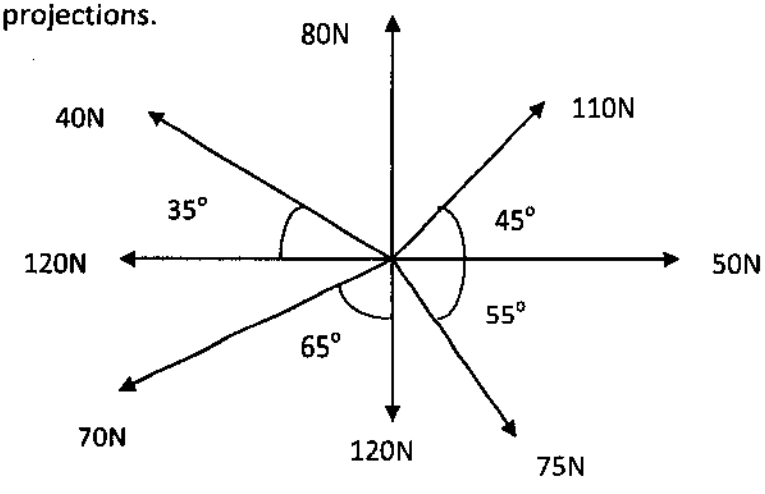
ii. Stress and strain

iii. Velocity and acceleration *(6mks)*

2(a) What do you understand by the term ***'Superposition'***? How does the equilibrium law relate to superposition? *(6mks)*

(b) Differentiate between the following terms ***'Equilibrant'*** and ***'Resultant'*** of two forces. *(4mks)*

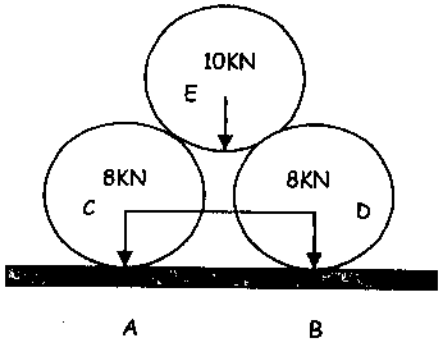
(C) Calculate the magnitude and direction of the resultant of the forces given below by method of projections. *(10mks)*



3(a) Explain what you understand by the term ***'free body diagram'***. *(5mks)*

(b) A smooth sphere of weight 10KN and radius 30cm rests on two other smooth spheres each of weight 8KN and radius 30cm as shown in the diagram below. The two base

supporting spheres are connected at their centres by a string CD whose length is 42.5cm and rests on a horizontal plane. Assuming that the surface area of contact of each base supporting sphere with the horizontal plane is $5.5cm^2$,



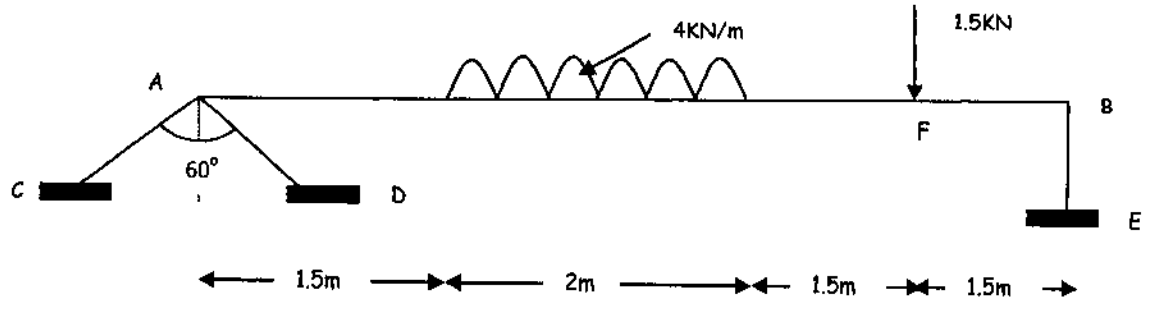
i. Draw the free body diagram of each of the spheres. *(5mks)*

ii. Find the tension in the string CD *(5mks)*

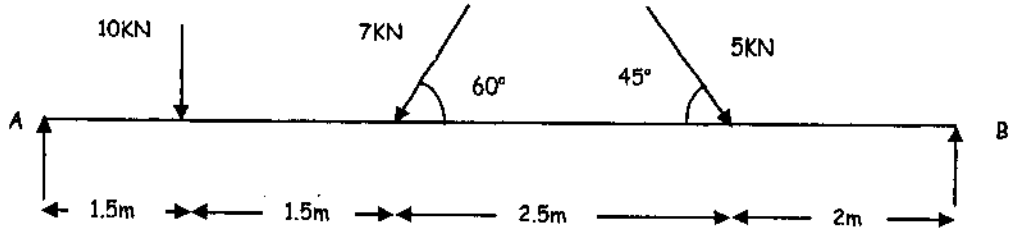
iii. Determine the magnitude and direction of the stress exerted on the floor at the points of contact A and B. *(5mks)*

4(a) State the conditions of equilibrium *(4mks)*

(b) A horizontal beam AB is supported by three hinged bars AC, AD and BE as shown below. The beam carries a uniformly distributed load and a point load. Neglecting the weight of the beam, calculate the reactions in the hinged bars. *(8mks)*



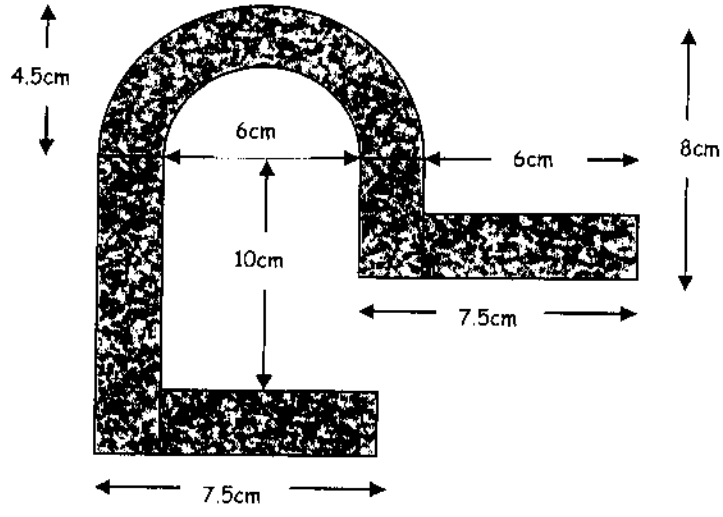
(c) Calculate the unknown reactions at A and B for the beam below. *(Neglect the self-weight of the beam)* *(8mks)*



5(a) Differentiate between '***Centroid***' and '***Centre of gravity***'. What condition(s) would the two be assumed to have the same co-ordinates? *(6mks)*

(b) Show that the moment of inertia of a circle of radius 'r' with respect to the centroidal axis is given by $Ix = Iy = \pi r^4/4$ *(4mks)*

(b) Determine the co-ordinates of the centroid (X_c, Y_c) of the stirrup as shown below. *(Assume uniform thickness all through the cross section).* *(10mks)*



6(a) Explain the following terms

i. Polar moment of Inertia
ii. Section Modulus
iii. Radius of Gyration *(6mks)*

(b). State the parallel axis theorem *(4mks)*

(c). Calculate the moment of inertia of the figure below with respect to each of the co-ordinate axes 'x' and 'y' *(10mks)*