EML 3004C INTROCUCTION TO MECHANICAL ENGINEERING

Spring 2007

Monday, February 26, 2007
2:00 -4:30 PM

First Test

NAME_____SSN# XXX-XX-_____

Please note that:
- **This exam is Closed Book, Closed Notes**.
- **Attempt all the 7 problems.**
- Be organized. Use the first 5 minutes to read through all problems to sort out which ones should be attempted first.
- Show your work.
- Write the equations you are using.
- Keep track of the units at your solution.
- Write your name on the first page of each problem.

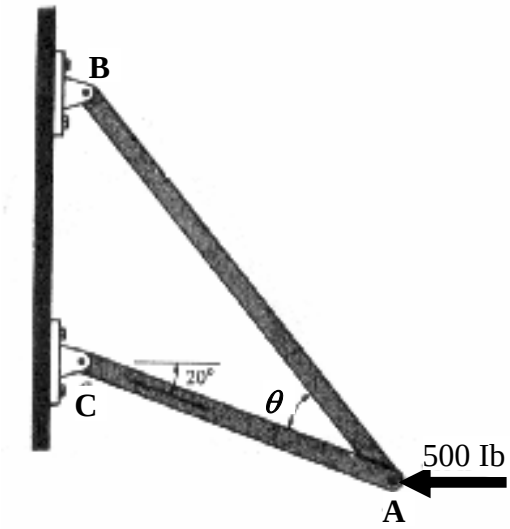
Problem –1 (10 points):

Indicated whether it is **TRUE** or **FALSE**

(i) Statics deals with bodies that have constant velocity.
(ii) In Statics, the particles that compose a rigid body remain at a fixed distance from one another both before and after a load is applied.
(iii) Equilibrium can only be achieved if the body is at rest.
(iv) The weight of a body remains constant regardless of its location.
(v) Vectors can only be added according to the parallelogram law.
(vi) The SI system considers force to be a derived unit.
(vii) The prefix mega (M) indicates 10^{-6}.
(viii) It is satisfactory to write k μ s as an appropriate composite unit.
(ix) The set of composite units s/kg are allowed.
(x) 2.25 rounded off to two significant figures is 2.3.
(xi) 2.05 rounded off to two significant figures is 2.0.

Problem –2 (15 points):

Determine the design angle θ (θ <90°) between the two struts so that the 500-lb horizontal force has a component of 600-lb directed from A toward C. That is the component of force acting along member AB?

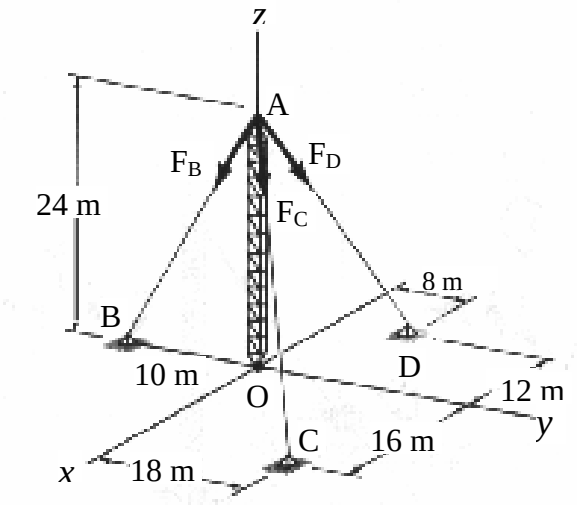


Problem –3 (15 points):

The antenna tower is supported by three cables. The forces in these cables are as follows: FB = 520 N, FC = 680 N, and FD = 560 N.

(i) Write the resultant of these three forces as a vector.

(ii) Determine the magnitude of the moment of the resultant about an axis through points C and D

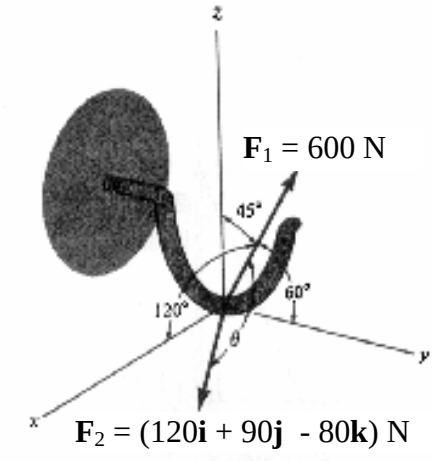


Problem –4 (15 points):

Two forces act on a block.

(i) Determine the angle θ between them.

(ii) What is the effective force pulling the hook from the wall i.e. the projection of the resultant force F_R along the positive y-axis?



$\mathbf{F}_1 = 600$ N

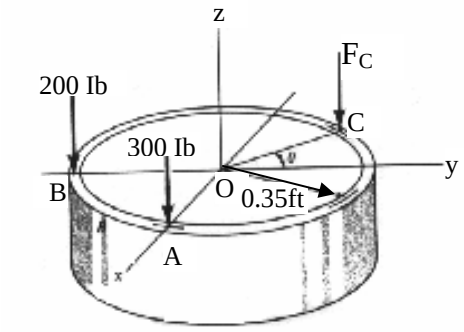
$\mathbf{F}_2 = (120\mathbf{i} + 90\mathbf{j} - 80\mathbf{k})$ N

Problem –5 (15 points):

Three parallel forces act on the rim of the tube. If it is required that the resultant force F_R of the system have a line of action that coincides with the central *z* axis,

(i) Determine the magnitude of F_C and its location θ on the rim.

(ii) What is the magnitude of the resultant force F_R?

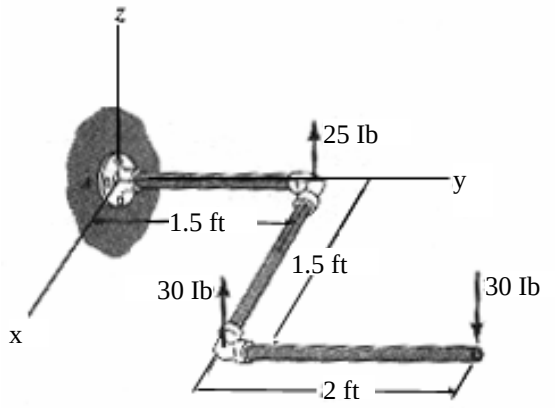


Problem –6 (15 points):

A force and couple act on the pipe assembly.

(i) Replace this system by an equivalent single resultant force.

(ii) Specify the location of the resultant force along the y axis, measured from A. The pipe lies in the x-y plane.



Problem –7 (15 points):

The window is held open by chain AB.

(i) Express the force *F* as a vector

(ii) Determine the moment of the force about the y-axis