King Saud University
College of Engineering
Department of Civil Engineering

FINAL EXAM
GE201 Statics – First Semester 1433- 34H
Safar 1434 H – January 2013
Time allowed: 3 hrs

Student name (in Arabic)  
Student number  
Student serial number in the class  
Section / Instructor  

Attempt all questions

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Total marks  50

Marks in words: ……………………………

Name and Signature of Instructor: ………………………………………………………………………
Question # 1  (12 Marks)

1-a (2 Marks )
Compute the magnitude of the moment about point \( A \) produced by the three forces and couple.

\[ \mathbf{F} = 2\mathbf{i} + 2\mathbf{j} \text{kN} \]
\[ \mathbf{A}(2,2) \]
\[ 10 \text{ kN.m} \]

1-b (2 Marks )
If the resulting force-couple system acting on the plate at point \( O \) is as shown in the figure, then replace the system by a single force \( \mathbf{R} \). Sketch the location of the force and find its intersection with \( x \)- and \( y \)-axes.

\[ \mathbf{R} = -3\mathbf{i} + 2\mathbf{j} \text{kN} \]
\[ 3 \text{ kN.m} \]

1-c (2 Marks )
i) Write \( \mathbf{F} \) as a vector.
ii) Determine the moment of the force \( \mathbf{F} \) about point \( O \), and express it as a vector.

\[ (2, 3, 0) \text{ m} \quad \mathbf{F} = 30 \text{kN} \quad (6, 3, 0) \text{ m} \]

\[ \mathbf{O} \]
\[ \mathbf{z} \]
Question # 1 (Contd.)

1-d (2 Marks)
Compute the magnitude of the resultant of the two forces shown below.

\[ F_2 = 40i + 90k \text{ kN} \]
\[ F_1 = 50j + 70k \text{ kN} \]

Solution

\[ R = 24 \text{ kN} \]

1-e (2 Marks)
Determine the angle \( \theta \), if the resultant \( R \) is vertical.

Solution

\[ \theta \]

1-f (2 Marks)
Write the vector expression of tension force \( T \)

Solution

\[ T = 24 \text{ kN} \]
Question # 2 (12 Marks)

2-a (2 Marks)
Compute $T$.

Solution

2-b (2 Marks)
Identify the zero force members.

Solution

2-c (2 Marks)
Determine the tension in the rope $CDE$.

Solution
Question # 2 (Contd.)

2-d (3 Marks)
Compute the force in member $BC$

![Force Diagram]

Solution

2-e (3 Marks)
Determine the moment of inertia about $x$-axis ($I_x$) for the shaded area using a vertical element as shown.

![Shaded Area Diagram]

Solution
**Question # 3 (10 Marks)**

For the section shown in the figure:

a) Locate the centroid \( \overline{X} \) and \( \overline{Y} \) of the shaded area from the \( y \)-and \( x \)-axes respectively.

b) Calculate the moment of inertia of the shaded area about \( x \)-axis (\( I_x \)).

c) Calculate the moment of inertia of the shaded area about that centroidal \( x_0 \) – axis which is parallel to \( x \)-axis (i.e. \( I_{x_0} \)).

**Hint:** Moment of inertia of a rectangular section about centroidal \( GG \)-axis is \( \frac{1}{12}bh^3 \) and about line \( AA \) is \( \frac{1}{3}bh^3 \).

**Solution**
Question # 4 (10 marks)

In the loaded beam shown in figure:

(a) Calculate the support reactions at A and I.

(b) Determine the shear force ($V$) and bending moment ($M$) values at the sections passing through
   i. point B; and
   ii. point G

Assume self-weight of the beam is negligible, and supports A and I are roller and pin, respectively.

Solution
**Question # 5 (6 Marks)**

The 100-kg block rests on the horizontal surface and a force $P$ is applied to the block at an angle of $30^\circ$. Determine the magnitude of force $P$ needed to start the block to slip (i.e. impending motion). The coefficient of static friction ($\mu_s$) between the block and the surface is 0.25.

![Diagram of block and force P](image)

$\mu_s = 0.25$