

THE UNIVERSITY OF MANITOBA

Date : Friday, December 7, 2012
Department & Course No : ENG 1440
Sections A01-A02-A03
Examination : Introduction to Statics

Page No : 1 of 7
Time : 6:00 p.m.
Duration : 2 Hours
Examiners : Dr. M. Bassuoni,
 Dr. R. Chitikireddy Dr. M. J. Frye
Seats: 1 - 243

Place : Frank Kennedy Brown Gym

Answer all questions on this exam question paper (you may write on the back of the pages):

Indicate the Following

Name:		
Student Number:	Section:	Professor:

Notes:

- **CLOSED BOOK.** Textbooks, notes, problems NOT permitted.
- **Calculators are permitted.**
- **All questions are of equal value.**
- **STRAIGHT EDGE IS REQUIRED.**
- **Wherever necessary a FBD must be drawn!!!!**

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\vec{V} = \vec{P} \times \vec{Q} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ P_x & P_y & P_z \\ Q_x & Q_y & Q_z \end{vmatrix} = \hat{i}(P_y Q_z - P_z Q_y) - \hat{j}(P_x Q_z - P_z Q_x) + \hat{k}(P_x Q_y - P_y Q_x)$$

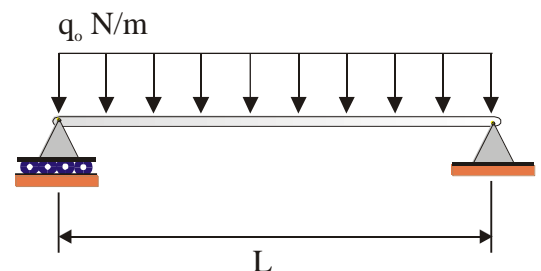
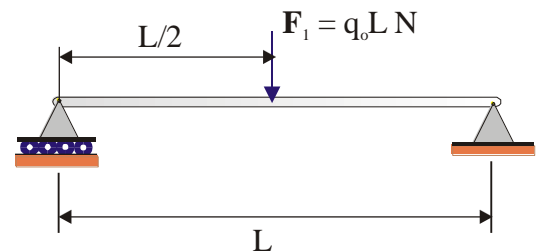
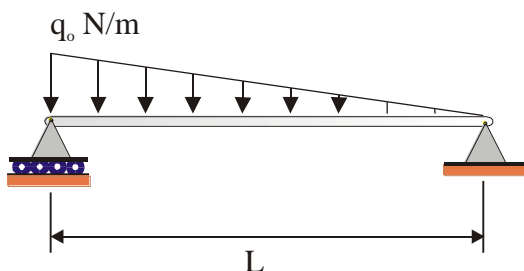
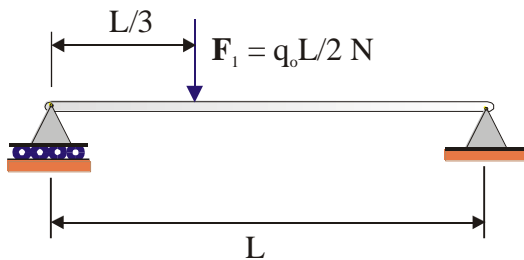
$$V = |\vec{V}| = \sqrt{V_x^2 + V_y^2 + V_z^2}$$

$$\cos \theta_x = \frac{V_x}{V}, \cos \theta_y = \frac{V_y}{V}, \cos \theta_z = \frac{V_z}{V}$$

$$\vec{M} = \vec{r} \times \vec{F}$$

$$M_{OL} = \vec{\lambda}_{OL} \cdot \vec{M}_O$$

$$\vec{P} \cdot \vec{Q} = P_x Q_x + P_y Q_y + P_z Q_z$$



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Question 1

Two wood framed walls are supported on top of concrete walls as shown in Figure 1. Two cables are attached to the stud wall at A . The tension force in cable AC is $T_{AC} = 20 \text{ kN}$ and the tension force in cable AD is $T_{AD} = 10 \text{ kN}$. A couple moment of 30 kN.m is applied at point B .

Determine:

- The equivalent force-couple at E ,
- The angle between cables AC and AD ,
- The projection of the T_{AC} force applied at A onto the line AD ,
- The moment of the T_{AC} force applied at A about the point F .
- The moment of the T_{AC} force applied at A about the line EF and
- The perpendicular distance from point E to the line of action T_{AC} .

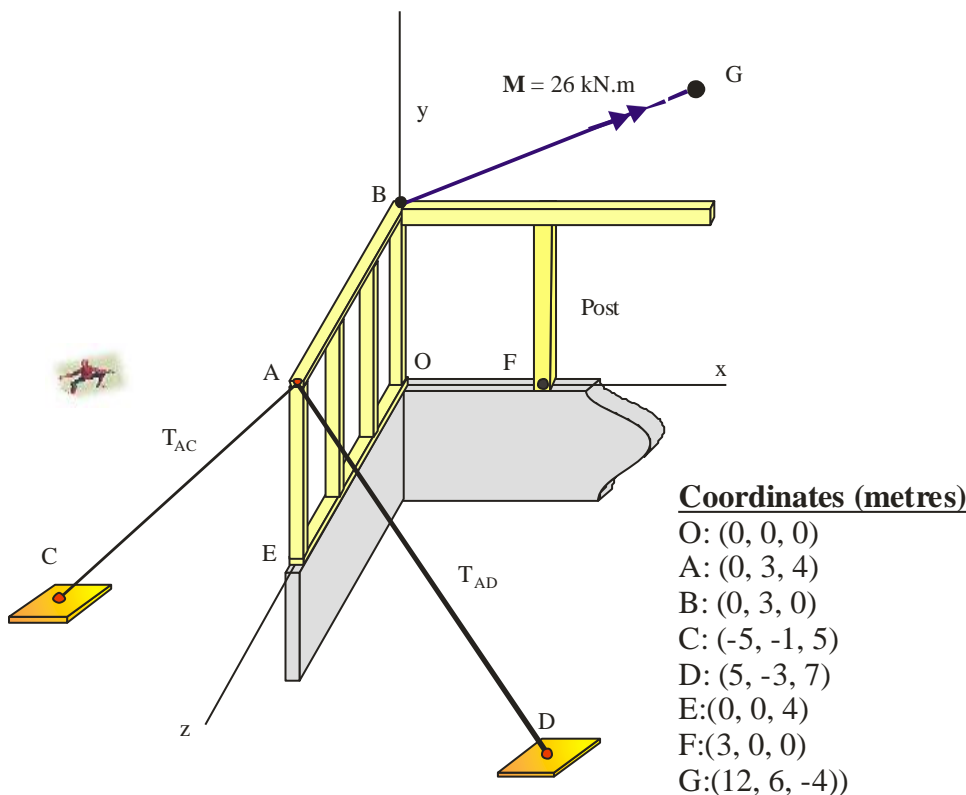


Figure 1

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A simple truss has a pin (hinge) support at A. Member DM is a “short link”. The beam JK is suspended from the truss by cables attached at joints H and B. The beam JK supports a distributed load as shown in Figure 2. Two smooth pulleys each of radius 0.2 m are attached to the truss at joints D and I, respectively. A cable passes over the pulleys and is attached to an external support at L. A 10 kN weight is suspended from the other end of the cable.

Determine:

The force in each member of the truss and state whether the member is in tension or compression or a zero force member.

PLACE YOUR RESULTS FOR THE TRUSS MEMBER FORCES ON THE FIGURE PROVIDED.

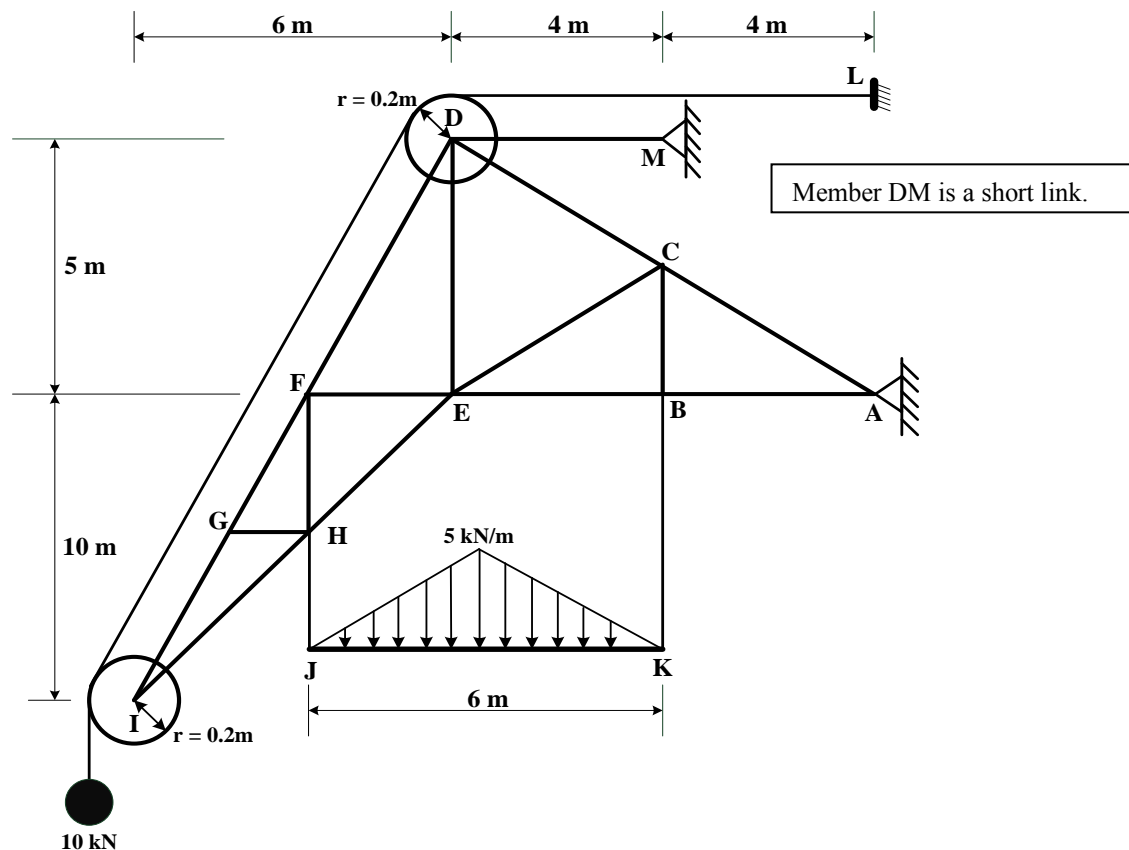
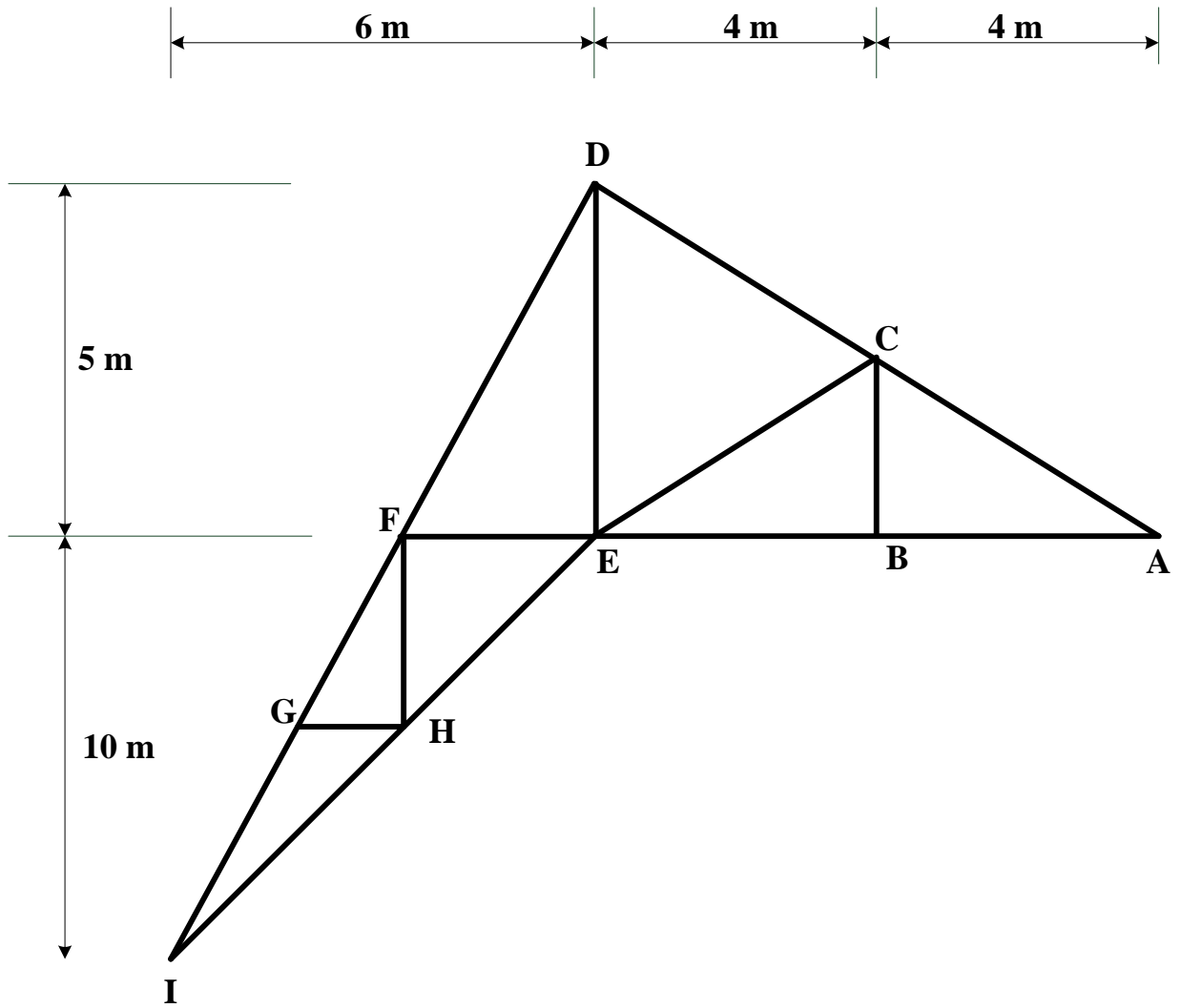


Figure 2

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Question 3

The frame shown in Figure 3 has external supports at A and C . A smooth pulley with a radius of 0.75 m is attached to the frame at E . The cable running over the pulley is attached to the wall at G and supports a 50 kN weight. Forces of 60 kN , 25 kN and 15 kN and a clockwise couple moment of 30 kN.m are applied to the frame as shown. Determine:

- The external reactions at A and C , and
- The forces acting on each member of the frame including the pulley.

Indicate your final results on separate Free Body Diagrams of each member of the frame including any pins included in the substructures.

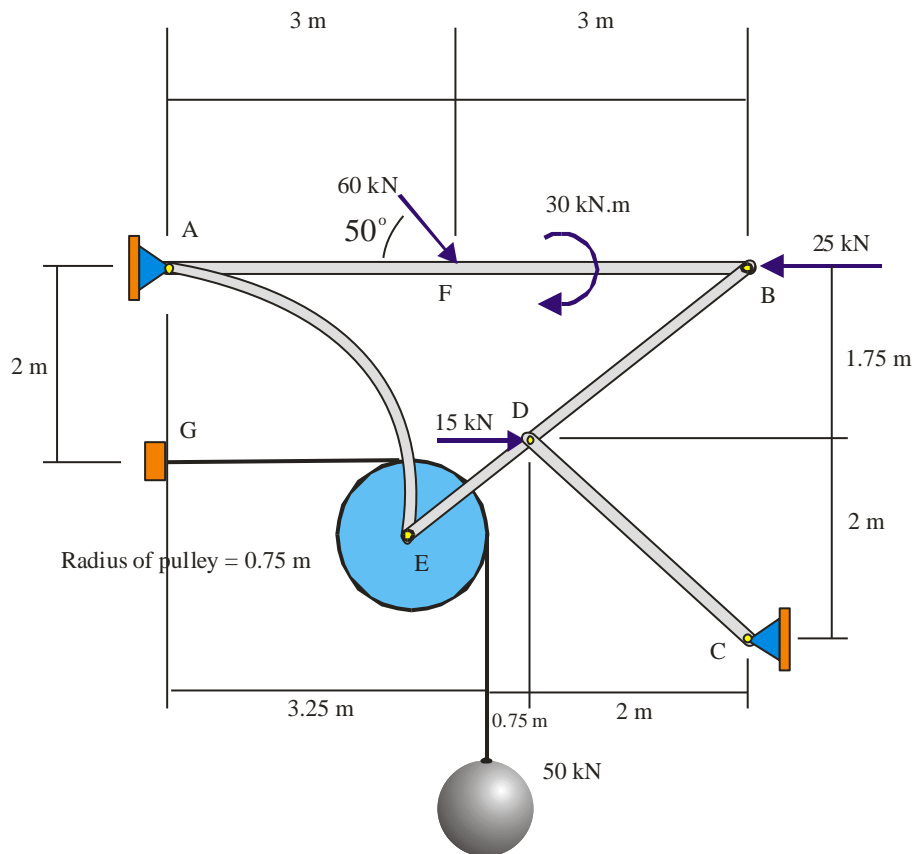
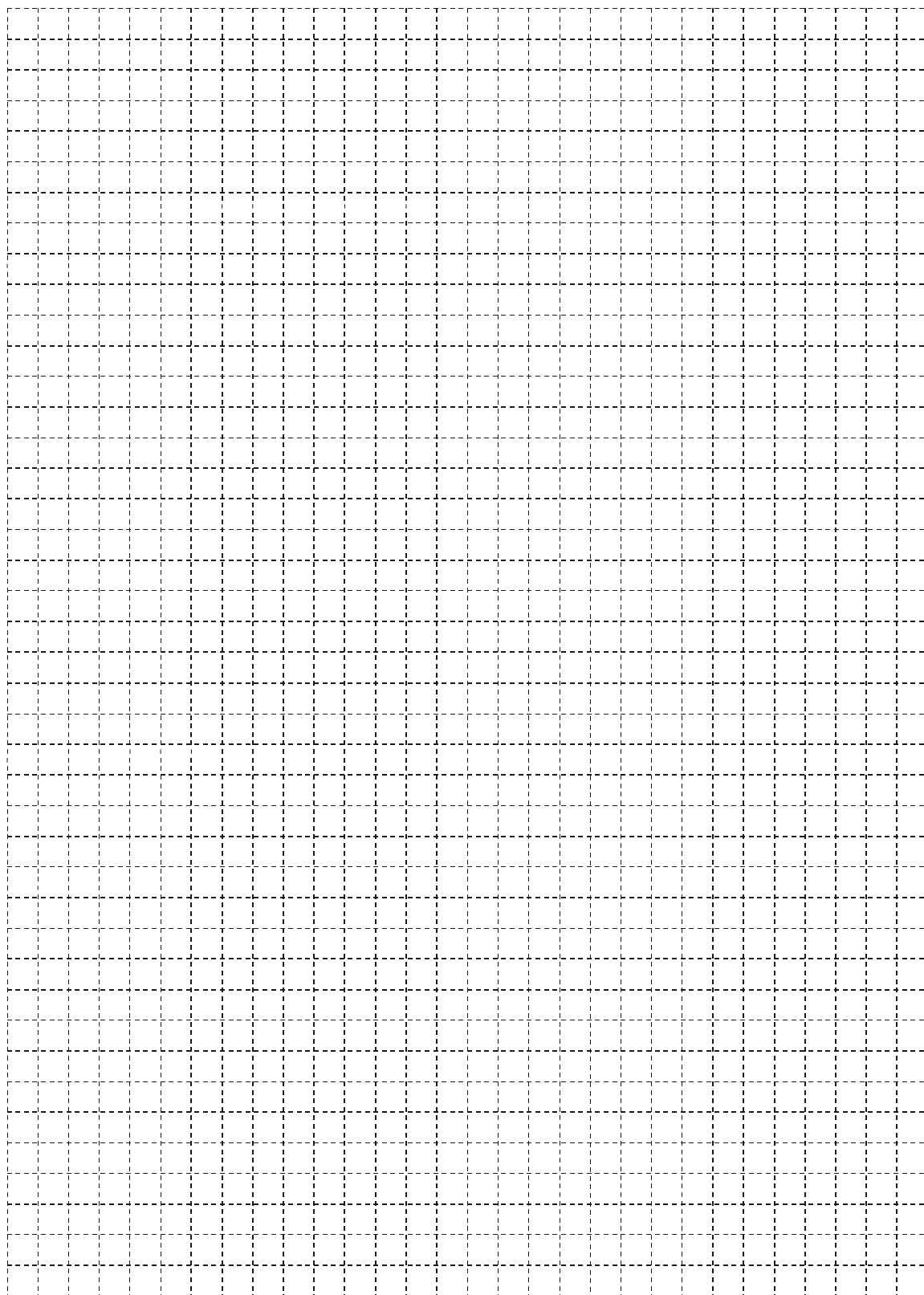


Figure 3

Name: _____ Student Number: _____



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