

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
 ORGANISATION OF ISLAMIC COOPERATION (OIC)
 DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid-Semester Examination

Course No.: CEE 4201

Course Title: Analytic Mechanics

Summer Semester: 2023 - 2024

Full Marks: 160

Time: 2 Hours

There are 4 (Four) questions. Answer all questions. The symbols have their usual meaning.

Assume reasonable value for any missing data.

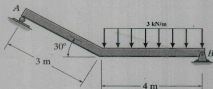
- 1(a) Show neat sketches for each of the following pairs of force systems to differentiate between them: CO1 9
PO1

- i. Coplanar parallel force system and non-coplanar parallel force system.
- ii. Coplanar concurrent force system and non-coplanar concurrent force system.
- iii. Coplanar parallel force system and coplanar non-parallel force system.

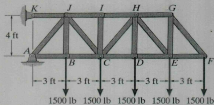
- 1(b) Derive the following equation for a flexible cord: CO1 13
PO1

$$y = \frac{k}{2} [e^{x/k} + e^{-x/k}]$$

- 2(a) Refer to the following figure. Determine the reactions at A and B. CO2 10
PO2

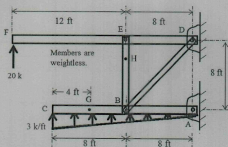


- 2(b) i. Determine the horizontal and vertical components of reactions at A and K for the following truss. CO2 36
PO2
 ii. Determine the internal forces in members GH, GE, GF, and HE of the following truss using Method of Sections. Indicate tension and compression members.
 iii. Verify your calculation for GH, GE, and GF members from the free-body diagram of joint G.



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- Determine the horizontal and vertical components of reactions at A and D for the following frame.
- Identify the two-force and multi-force members. Determine the internal forces of the two-force members. Indicate if the two-force members are in tension or compression.
- Determine the internal normal force, shear force, and bending moment at points G and H.

CO2 46
PO2

- 4(a) A flexible cable weighing 3 lb/ft is strung between two supports. One support is 80 ft higher than the other and the sag measured from the upper support is 130 ft. The tension in the cable at the lower support is 9000 lb. Calculate the following:

CO2 23
PO2

- Distance between the two supports.
- Total length of the cable.
- Slope in degree at the upper support.
- Tension at the upper support.

Use catenary equations for your calculations.

- 4(b) A 3-ft diameter oil drum is pulled by a force F , as shown in the following figure, to move over an obstruction on an inclined surface. The drum weighs 500 lb and the coefficient of static friction for all surfaces is 0.3. Find F when motion impends. Is this impending motion spinning or rolling?

CO2 23
PO2