

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination
Course No: ME 4103
Course Title: Statics

Winter Semester : A.Y. 2024-2025
Time : 2 Hour
Full Marks : 120

*Answer all questions. The symbols have their usual meanings.
Draw the free-body diagram if required. The right column also indicates the course objective (CO) and Program outcome (PO), and WK, WP, WA addressed by each question*

Q-01(a). Two forces F_1 and F_2 act on the screw eye. If the resultant force F_R has a magnitude of **150 lb** and the coordinate direction angles shown, determine the magnitude of F_2 and its coordinate direction angles.

15
(CO1)
(PO2)
WK2

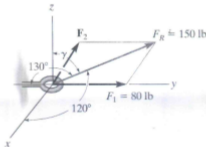


Fig 1(a)

Q-01(b). Determine the magnitudes of the components of force $F = 90$ lb acting parallel and perpendicular to diagonal AB of the crate.

15
(CO1)
(PO2)
WK2

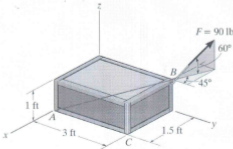


Fig 1(b)

Q-02(a). Determine the tension developed in the three cables required to support the traffic light, which has a mass of 20 kg. Take $h = 3.5$ m.

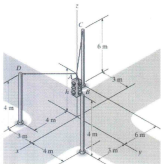


Fig 2(a)

Q-02(b). The lift sling is used to hoist a container having a mass of 500 kg. Determine the force in each of the cables AB and AC as a function of θ . If the maximum tension allowed in each cable is 5 kN, determine the shortest lengths of cables AB and AC that can be used for the lift. The center of gravity of the container is located at G.

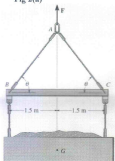


Fig 2(b)

Q-02(c). Determine the stretch in each spring for equilibrium of the 2 kg block. The springs are shown in the equilibrium position.

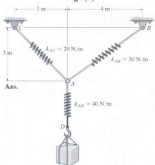


Fig 2(e)

Q-03(a). Replace the force system acting on the post by a resultant force, and specify where its line of action intersects the post AB measured from point A.

15
(CO2)
(PO2)
WK2

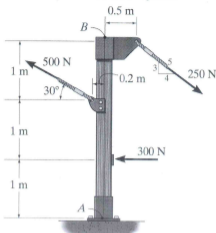


Fig 3(a)

Q-03(b). If the resultant couple of the three couples acting on the triangular block is to be zero, determine the magnitude of forces F and P .

15
(CO2)
(PO2)
WK2

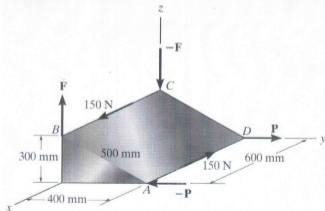


Fig 3(b)

Q-04(a). Determine the components of reaction at the ball-and-socket joint **A** and the tension in each cable necessary for equilibrium of the rod.

15
(CO2)
(PO2)
WK2

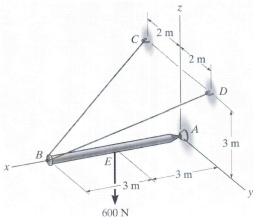


Fig 4(a)

Q-04(b). The boom supports the two vertical loads. Neglect the size of the collars at **D** and **B** and the thickness of the boom. Compute the horizontal and vertical components of force at the pin **A** and the force in cable **CB**. Set $F_1 = 800 \text{ N}$ and $F_2 = 350 \text{ N}$.

15
(CO2)
(PO2)
WK2

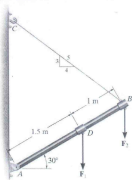


Fig 4(b)