VIT
Vellore Institute of Technology

# Final Assessment Test – November 2019

Course: MEE1002 - Engineering Mechanics
Class NBR(s): 1155 / 2228
Time: Three Hours
Slot: B2+TB2+V4
Max. Marks: 100

**KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE**

**Answer any TEN Questions**
**(10 X 10 = 100 Marks)**

1. The 20 kg mass is suspended by cables attached to three vertical posts of height 2m as shown in Fig.1. Point *A* is at (0, 1.2, 0) m. Determine the tensions in cables *AB*, *AC*, and *AD*.

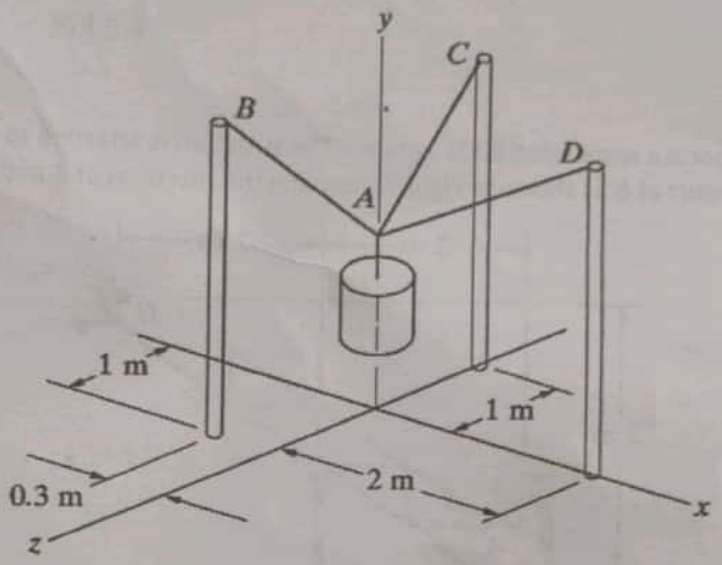


Fig.1.

2. The 200 kg slider at *A* is held in place on the smooth vertical bar by the cable *AB* as shown in Fig.2. Determine the moment about the bottom of the bar (point *C* with coordinates $x = 2$ m, $y = z = 0$) due to the force exerted on the slider by the cable.

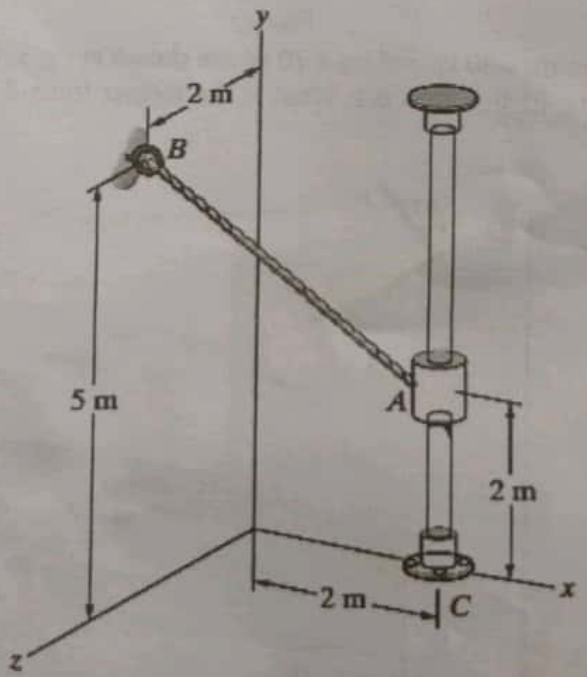


Fig.2.

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ON TELEGRAM TO JOIN

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3. Determine the axial forces in members *AB* and *AC* of the truss shown in Fig.3. Assume support B is a roller support.

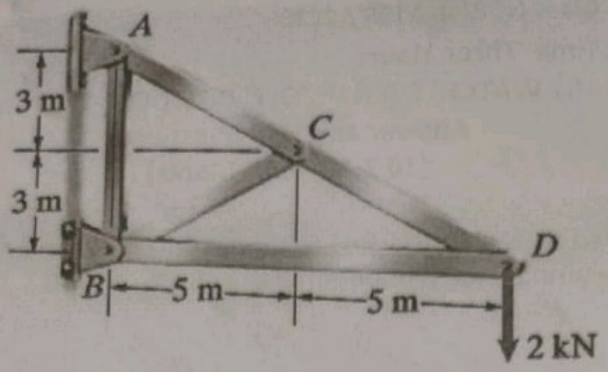


Fig.3.

4. The structure AB supports a suspended 2000 kg mass. The structure is attached to a slider in a vertical slot at A and has a pin support at B as shown in Fig.4. Determine the reactions at A and B.

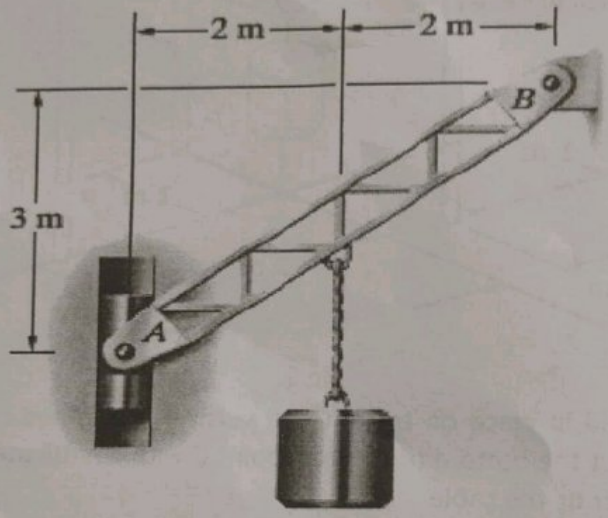


Fig.4.

5. *The masses of the blocks are* $m_A = 30$ kg and $m_B = 70$ kg are shown in Fig.5. Between all of the contacting *surfaces, coefficient of static friction* $\mu_s = 0.1$. What is the largest force *F* that can be applied without *causing the blocks to slip?*

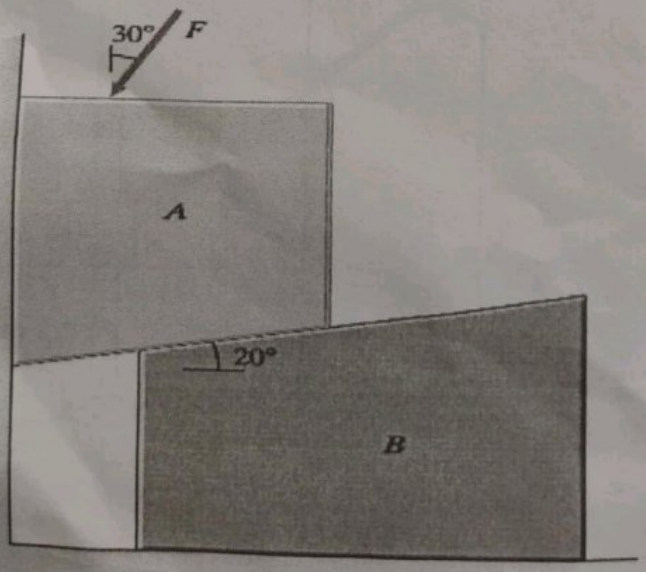


Fig.5.



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6. The system of two blocks having masses 10 kg and 5kg, cable, and fixed pulley is initially at rest as shown in Fig.6. Determine the horizontal force $P$ necessary to cause motion when (a) $P$ is applied to the 5kg block and (b) $P$ is applied to the 10kg block. Determine the corresponding tension $T$ in the cable for each case.

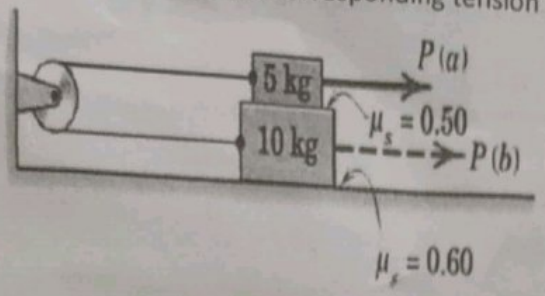


Fig.6.

7. Determine the product moment of inertia Ixy about the xy axes for the section shown in Fig.7.

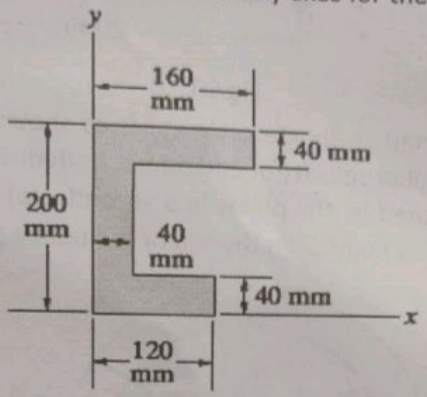


Fig.7.

8. For the section shown in Fig.8, the moments of inertia with respect to the x and y axes have been computed and are known to be $I_x = 10.38\ cm^4$ $I_y = 6.97\ cm^4$. Determine (a) the orientation of the principal axes of the section about O, (b) the values of the principal moments of inertia of the section about O.

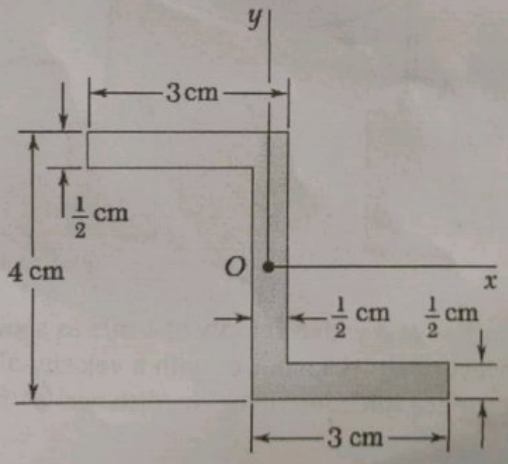


Fig.8.

9. Using the principle of virtual work, determine the force $P$ necessary for the mechanism to be in equilibrium as shown in Fig.9.

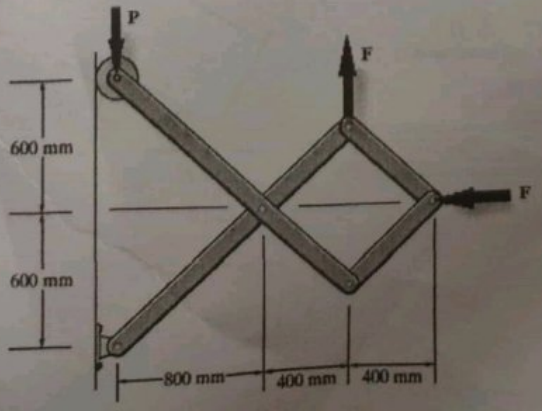


Fig.9.



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10. As relay runner 'A' enters the 20m long exchange zone with a speed of 12.9 m/s, he begins to slow down. He hands the baton to runner 'B' 1.82 sec later as they leave the exchange zone with the same velocity. Determine (a) the uniform acceleration of each of the runners, (b) when runner 'B' should begin to run.

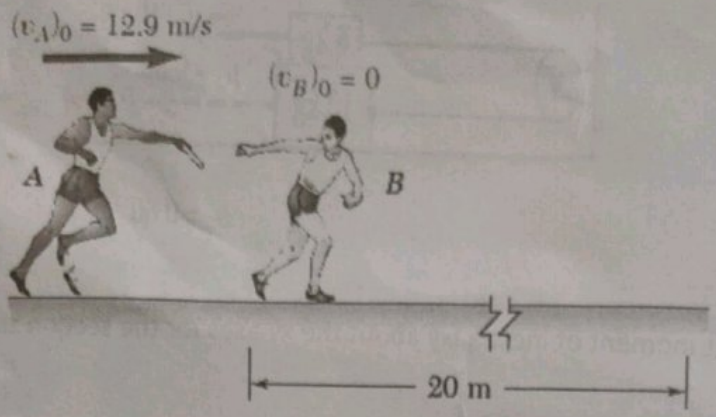


Fig.10.

11. A pulley and two loads are connected by inextensible cords as shown in Fig.11. Load *A* has a constant acceleration of 300 mm/s$^2$ and an initial velocity of 240 mm/s, both directed upward as shown. Determine (*a*) the number of revolutions executed by the pulley in 3 seconds, (*b*) the velocity and position of load *B* after 3 seconds, (*c*) the acceleration of point *D* on the rim of the pulley at $t = 0$.

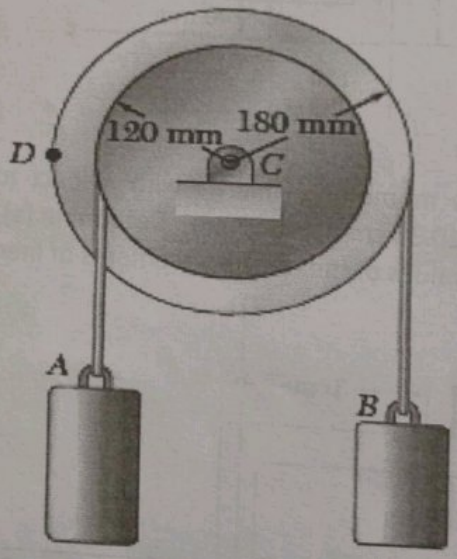


Fig.11.

12. Packages are thrown down an incline at *A* with a velocity of 1 m/s as shown in Fig.12. The packages slide along the surface *ABC* to a conveyor belt which moves with a velocity of 2 m/s. Knowing that $\mu_k = 0.25$ between the packages and the surface *ABC*, determine the distance '*d*' if the packages are to arrive at *C* with a velocity of 2 m/s.

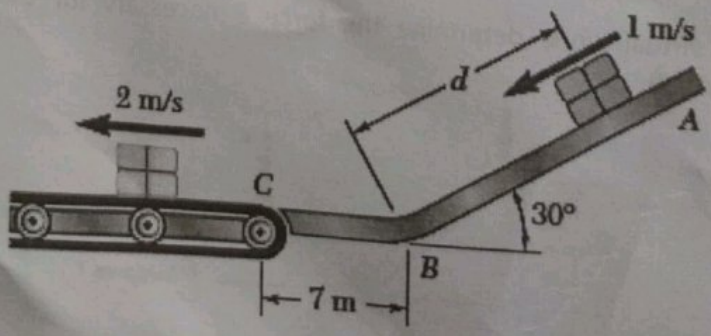


Fig.12.

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