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Question Paper Code : 97085

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Second Semester

Civil Engineering

GE 6253 — ENGINEERING MECHANICS

(Common to all Branches except Electrical and Electronics Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Biomedical Engineering, Computer and Communication Engineering, Computer Science and Engineering, Electronics and Communication Engineering, Medical Electronics and Information Technology)

(Regulation 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the static equilibrium equations.
2. Define Lami's theorem.
3. Define couple.
4. State Varignon's theorem.
5. State parallel axis theorem.
6. Define principle moments of inertia.
7. Define Newton's law (second law) of motion.
8. Give the equation of work energy for a rectilinear motion.

9. Define limiting friction.
10. Define instantaneous centre of rotation.

PART B — (5 × 16 = 80 marks)

11. (a) Four forces act on bolt A as shown. Determine the resultant of the forces on the bolt shown in fig.Q.11(a).

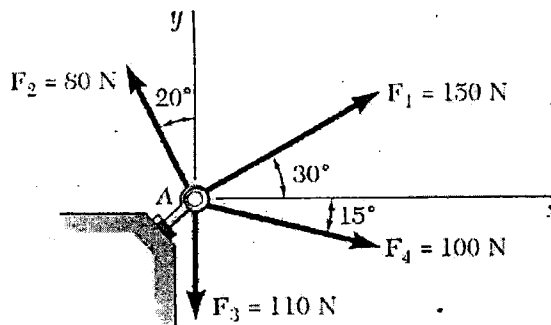


Fig.Q.11(a)

Or

- (b) Consider the 75-kg crate shown in the space diagram of Fig. Q.11 (b). This crate was lying between two buildings, and it is now being lifted onto a truck, which will remove it. The crate is supported by a vertical cable, which is joined at A to two ropes which pass over pulleys attached to the buildings at B and C. It is desired to determine the tension in each of the ropes AB and AC.

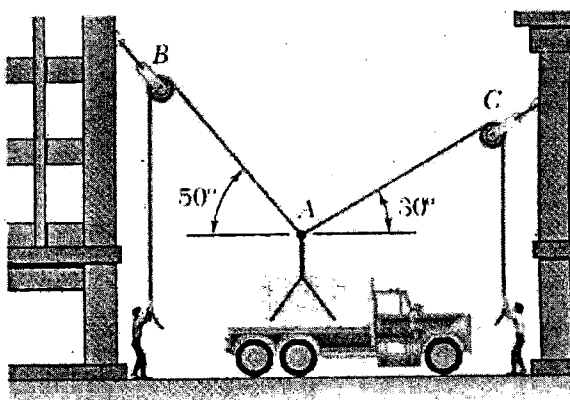


Fig. Q.11(b)

12. (a) Determine the magnitude and direction of the smallest force F , shown in Fig. Q.12(a) which will maintain the package shown in equilibrium. Note that the force exerted by the rollers on the package is perpendicular to the incline.

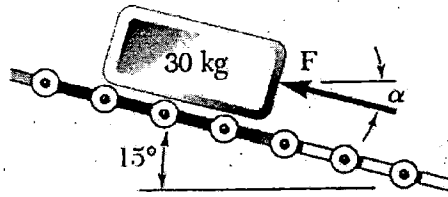


Fig. Q.12(a)

Or

- (b) A 20-kg ladder Fig. Q.12(b) used to reach high shelves in a store room is supported by two flanged wheels A and B mounted on a rail and by an unflanged wheel C resting against a rail fixed to the wall. An 80-kg man stands on the ladder and leans to the right. The line of action of the combined weight W of the man and ladder intersects the floor at point D. Determine the reactions at A, B, and C.

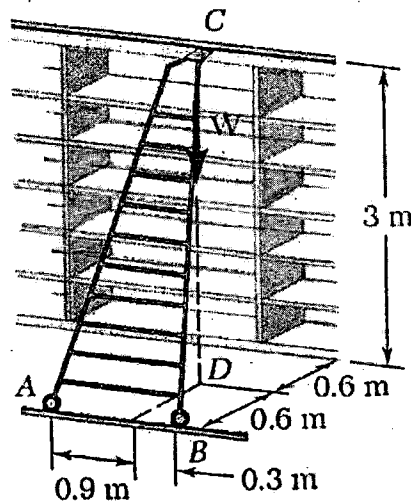


Fig. Q.12(b)

13. (a) Determine the moment of inertia of the shaded area as shown in Fig. Q.13(a) with respect to the x axis.

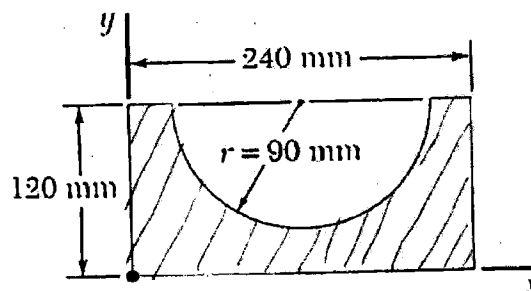


Fig. Q.13(a)

Or

- (b) For the section in Fig. Q.13(b), the moments of inertia with respect to the x and y axes have been computed and are known to be $I_x = 10.38 \text{ mm}^4$, $I_y = 6.97 \text{ mm}^4$. Determine :
- (i) The orientation of the principal axes of the section about O (8)
 - (ii) The values of the principal moments of inertia of the section about O. (8)

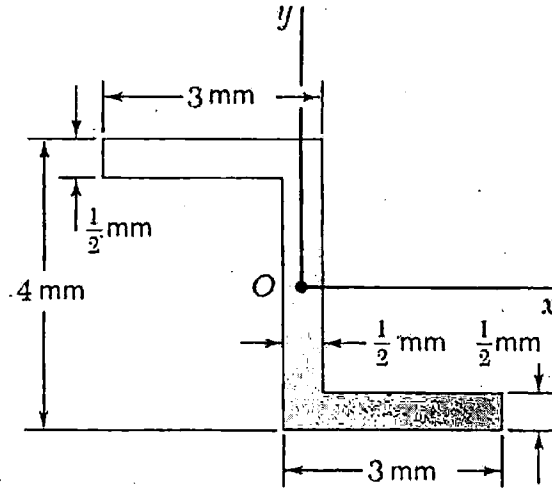


Fig. Q.13(b)

14. (a) The two blocks in Fig. Q.14(a) start from rest. The horizontal plane and the pulley are frictionless, and the pulley is assumed to be of negligible mass. Determine the acceleration of each block and the tension in each cord.

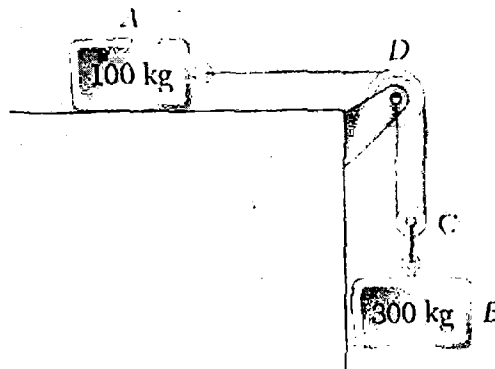


Fig. Q.14(a)

Or

- (b) Two blocks are joined by an inextensible cable as shown in Fig Q.14(b). If the system is released from rest, determine the velocity of block A after it has moved 2 m. Assume that the coefficient of kinetic friction between block A and the plane is $\mu_k = 0.25$ and that the pulley is weightless and frictionless.

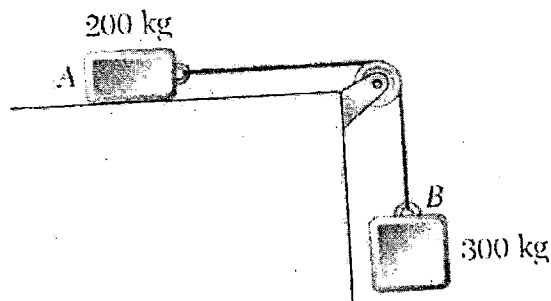


Fig. Q.14(b)

15. (a) A support block is acted upon by two forces as shown in Fig. Q.15(a). Knowing that the coefficients of friction between the block and the incline are $\mu_s = 0.35$ and $\mu_k = 0.25$, determine the force P required
- (i) To start the block moving up the incline, (6)
 - (ii) To keep it moving up, (6)
 - (iii) To prevent it from sliding down. (4)

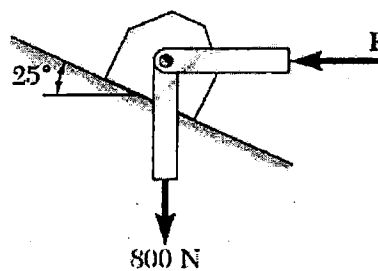


Fig. Q.15(a)

Or

- (b) A cord is wrapped around the inner drum of a wheel and pulled horizontally with a force of 200 N as figure Q.15(b). The wheel has a mass of 50 kg and a radius of gyration of 70 mm. Knowing that $\mu_s = 0.20$ and $\mu_k = 0.15$, determine the acceleration of G and the angular acceleration of the wheel.

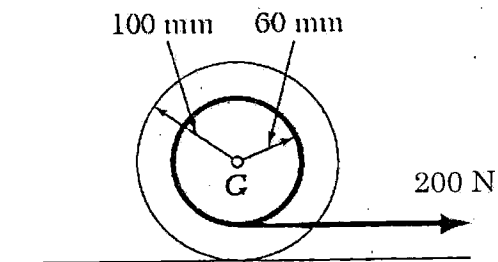


Fig. Q.15(b)