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J 3913

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Second Semester

Mechanical Engineering

ME 2151 — ENGINEERING MECHANICS

(Regulation 2008)

(Common to Aeronautical Engineering, Automobile Engineering, Civil Engineering,
Production Engineering, Marine Engineering, Petroleum Engineering,
Biotechnology, Chemical Engineering, Fashion Technology, Polymer Technology,
Rubber and Plastics Technology, Textile Technology)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is unit vector?
2. State the principle of transmissibility.
3. State the general condition of equilibrium of a particle.
4. State Varignon's theorem.
5. What is radius of gyration?
6. State principal axes of inertia.
7. State Newton's law concerning equilibrium of particle.
8. What do you mean by impact of elastic bodies?
9. What is coloumb friction?
10. Define coefficient of Kinetic friction.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Distinguish between scalar and vector quantities.
(ii) Forces R, S, T, U are collinear. Forces R and T act from left to right. Forces S and U act from right to left. Magnitudes of the forces R, S, T, U are 40 N, 45 N, 50 N and 55 N respectively. Find the resultant of R, S, T, U.

Or

- (b) (i) State the parallelogram law of forces
(ii) Find the magnitude and position of the resultant of the system of forces shown in Fig. 1.

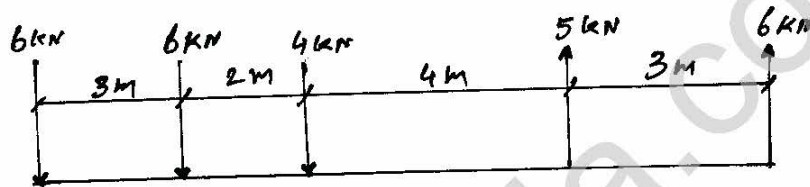


Fig. 1.

12. (a) (i) State the polygon law of forces.
(ii) A system of forces acts as shown in Fig. 2. Find the magnitude of P and Q, so that the resultant of the force system passes through A and B.

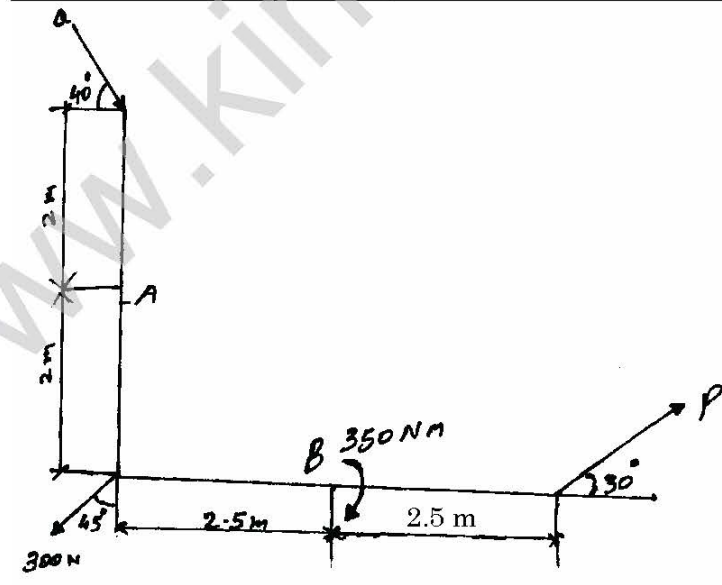


Fig. 2.

Or

- (b) (i) State the principle of moments.
- (ii) A rigid rod PQ is acted upon by a system of parallel forces as shown in Fig. 3. Find the equivalent single force for the given system of forces. Also find the equivalent force-moment system at A. Solve the problem using vector method.

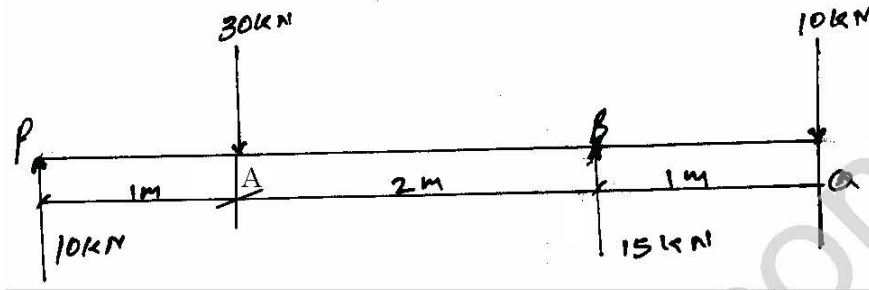


Fig. 3.

13. (a) (i) Define moment of inertia of a body.
- (ii) Find the moment of inertia of the section shown in Fig. 4. about the centroidal axes. (Dimensions in mm)

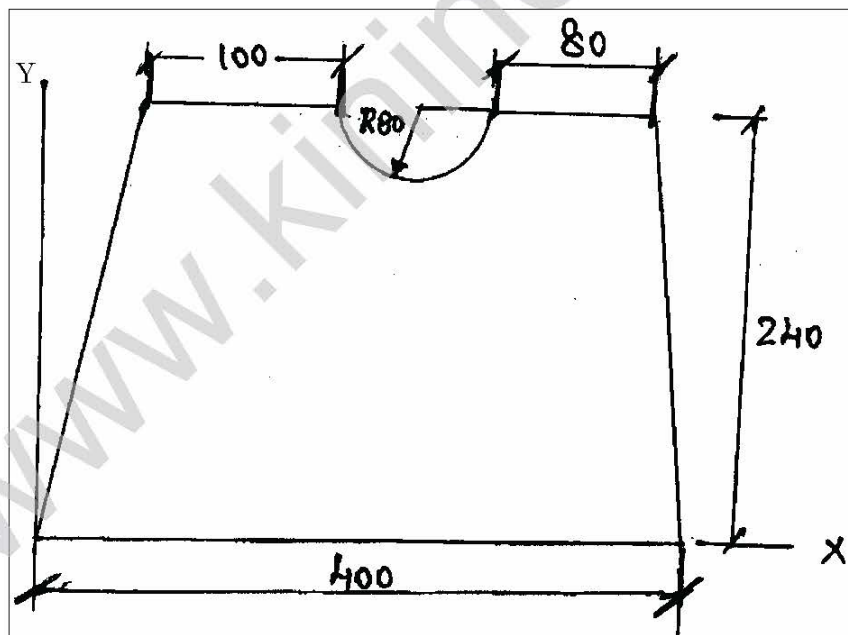


Fig. 4.

Or

- (b) (i) Discuss radius of gyration of an area.
- (ii) Find the polar moment of inertia of a T section shown in Fig. 5. about an axis passing through its centroid. Also find the radius of gyration with respect to the polar axis. (Dimensions in mm)

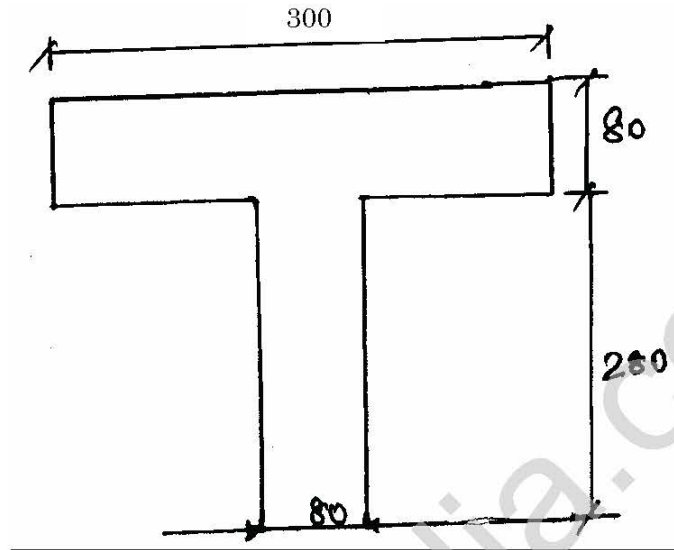


Fig. 5.

14. (a) (i) What is impulsive force and impulsive motion?
- (ii) A block and pulley system is shown in Fig. 6. The coefficient of kinetic friction between the block and the plane is 0.25. The pulley is frictionless. Find the acceleration of the blocks and the tension in the string when the system is just released. Also find the time required for 200 kg block to come down by 2 m.

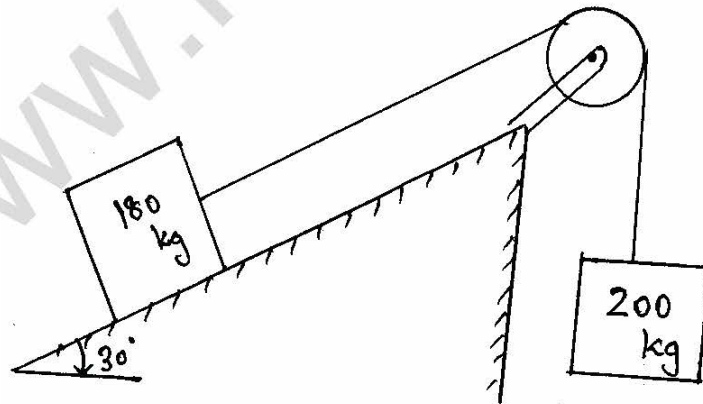


Fig. 6.

Or

- (b) (i) State the law of conservation of momentum.
- (ii) A block of mass 50 kg slides down a 35° incline and strikes a spring 1.5 m away from it as shown in Fig. 7. The maximum compression of the spring is 300 mm when the block comes to rest. If the spring constant is 1 kN/m, find the coefficient of kinetic friction between the block and the plane.

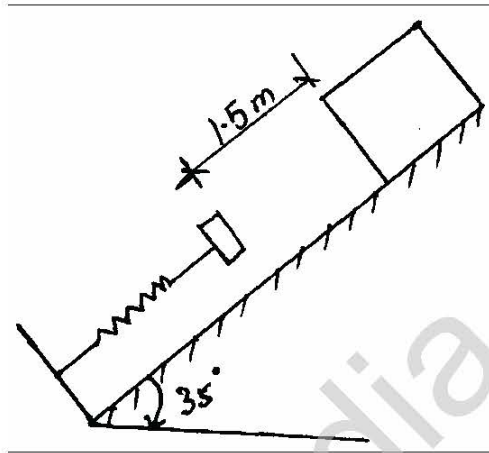


Fig. 7.

15. (a) (i) What is limiting friction?
- (ii) A pull of 250 N inclined at 30° to the horizontal plane is required just to move a body kept on a rough horizontal plane. But the push required just to move the body is 300 N. If the push is inclined at 30° to the horizontal, find the weight of the body and the coefficient of friction, and the coefficient of friction.

Or

- (b) (i) State the factors influencing friction.
- (ii) Two blocks of weight 500 N and 900 N connected by a rod are kept on an inclined plane as shown in Fig. 8. The rod is parallel to the plane. The coefficient of friction between 500 N block and the plane is 0.3 and that between 900 N block and the plane is 0.4. Find the

inclination of the plane with the horizontal and the tension in the rod when the motion down the plane is just about to start.

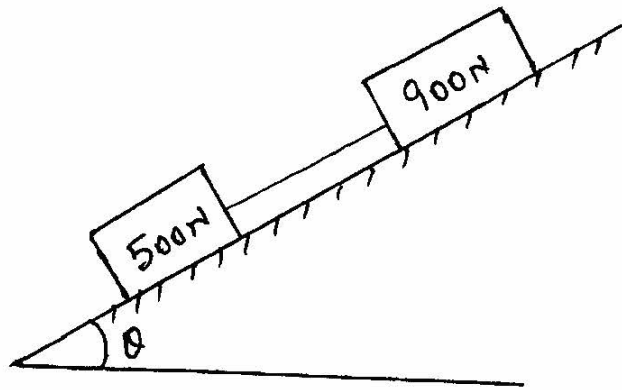


Fig. 8.

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