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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 31556

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Second Semester

Civil Engineering

ME 2151/ME 25/10122 ME 205/080120002/CE 1151 — ENGINEERING MECHANICS

(Common to Aeronautical, Automobile, Marine, Mechanical, Production, Chemical, Petroleum Engineering, Biotechnology, Polymer, Textile, Textile (Fashion), Plastic Technology, Materials Science and Engineering, Manufacturing Engineering, Mechatronics Engineering, Industrial Engineering, Industrial Engineering and Management, Environmental Engineering, Geoinformatics, Mechanical and Automation Engineering, Petrochemical Engineering, Chemical and Electrochemical Engineering, Petrochemical Technology, Pharmaceutical Technology, Textile Chemistry and Mechanical Engineering (Sandwich))

(Regulation 2008/2010)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain the principle of transmissibility.
2. State the necessary and sufficient conditions for equilibrium of a particle in two dimensions.
3. State Varignon's theorem of moments.
4. What is meant by a force-couple system?
5. Define centroid and centre of gravity of an area.
6. What do you mean by polar moment of inertia?
7. Write the work-energy equation of particles.
8. State impulse-momentum principle.
9. Give the causes of rolling resistance.
10. What is general plane motion?

PART B — (5 × 16 = 80 marks)

11. (a) Determine the magnitude and direction of force $\overline{F}$ shown in Fig. 1 so that particle 'A' is in equilibrium.

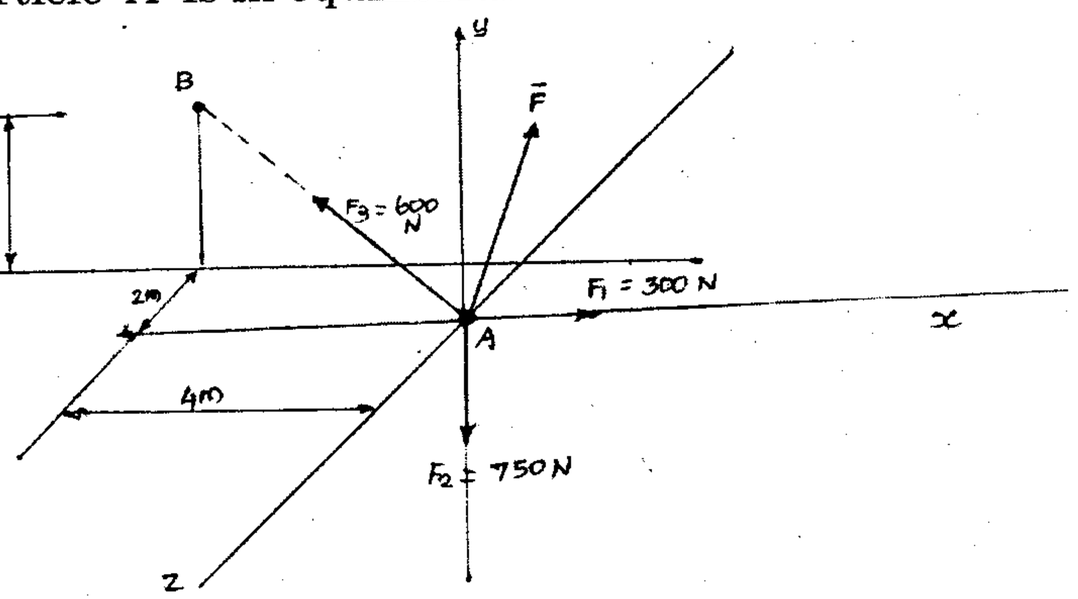

Fig. 1

Or

(b) Three cables are used to support the 10 kg cylinder shown in Fig. 2. Determine the force developed in each cable for equilibrium.

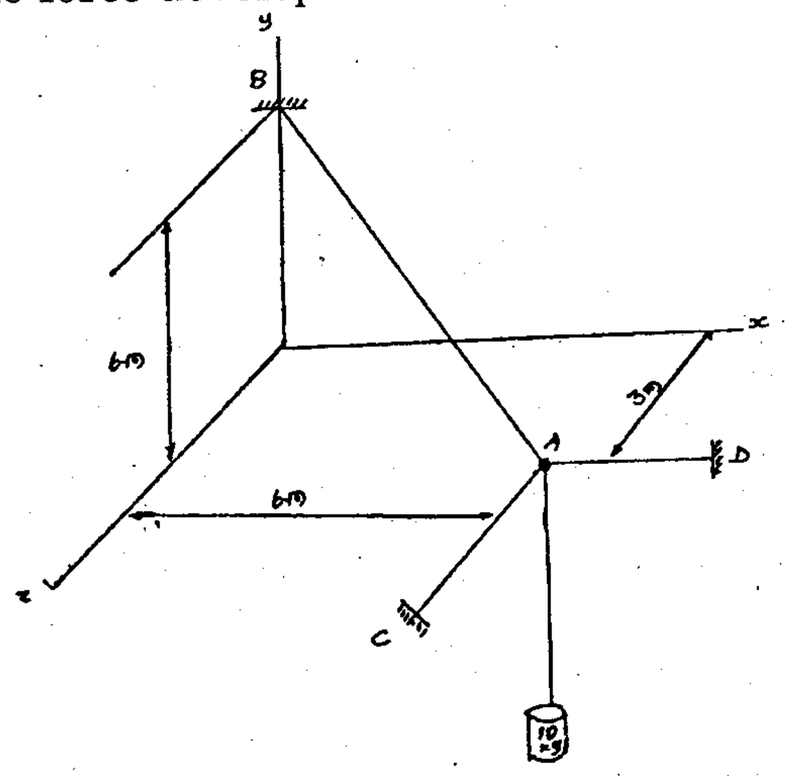

Fig. 2

12. (a) Determine the reaction at the pin at *A* and in the cable shown in Fig. 3 required to support the 300 kg crate. Neglect the weight of the connecting rod *AB*.

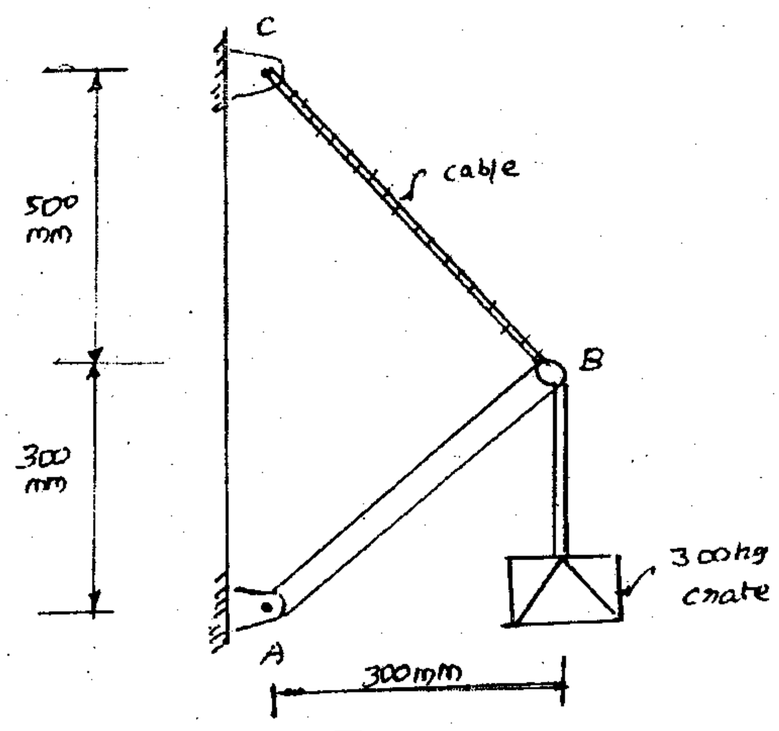

Fig. 3

Or

(b) Compute the moment of the force $P = 1500\,N$ and of the force $Q = 1200\,N$ shown in Fig. 4 about points *A*, *B* and *C*.

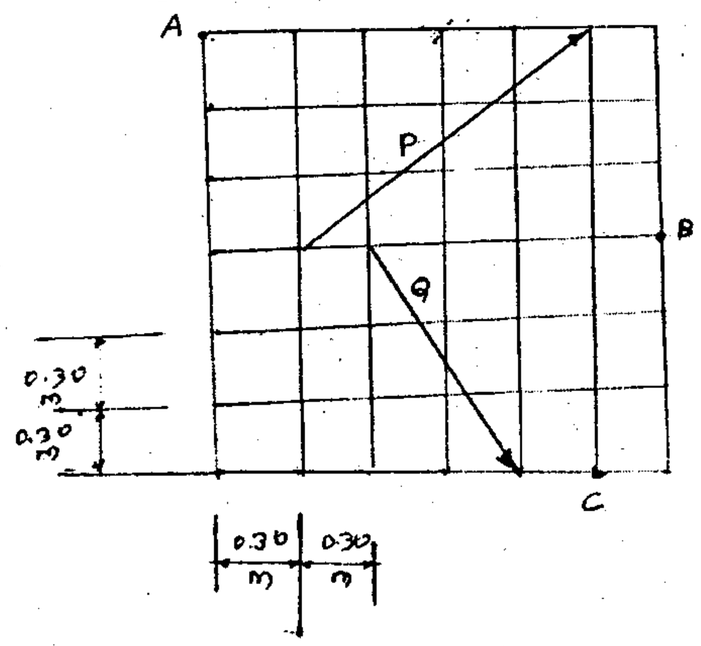

Fig. 4

13. (a) Determine the polar moment of inertia of the section shown in Fig. 5.

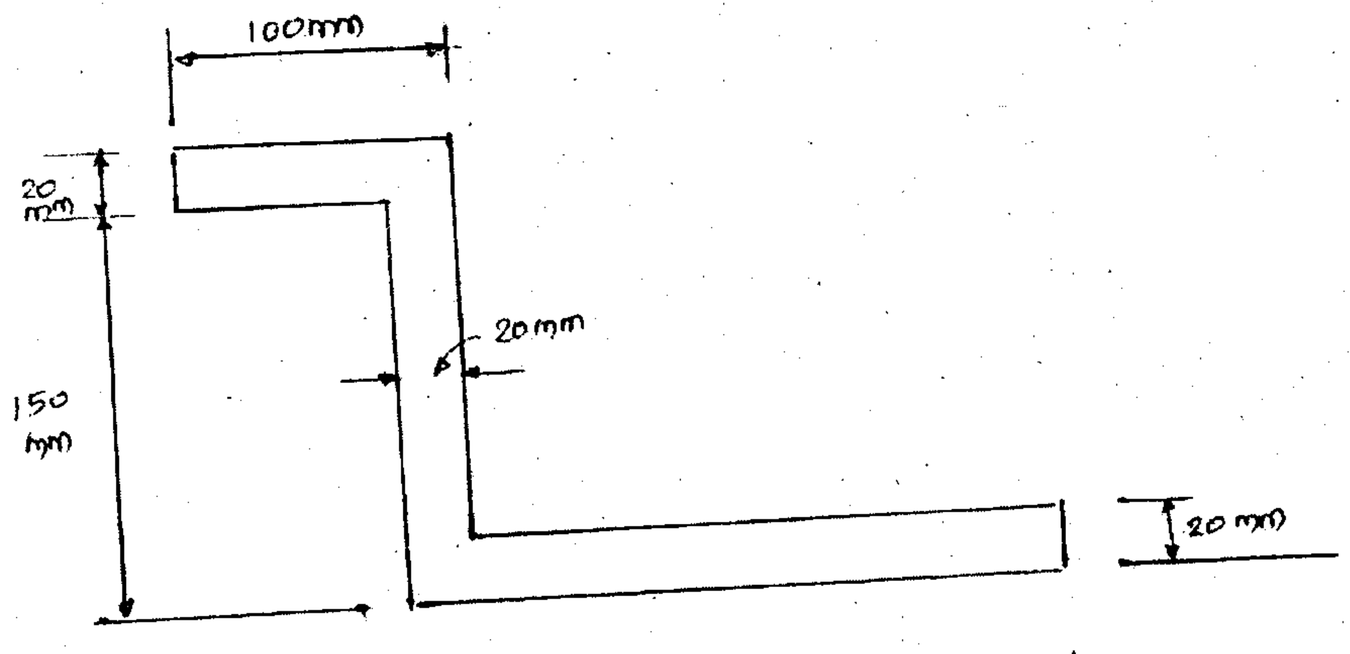

Fig. 5

Or

(b) Determine the principal moments of inertia of the section shown in Fig. 6.

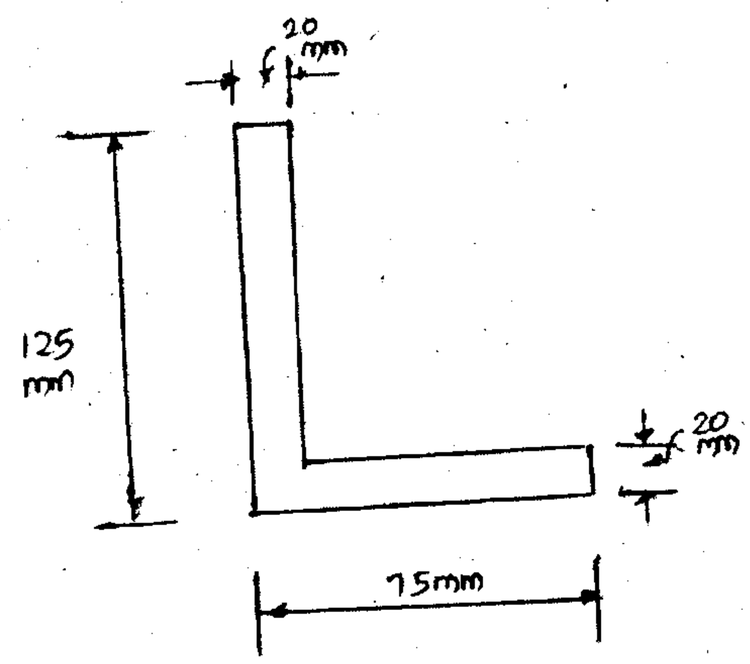

Fig. 6

14. (a) The 50 kg block shown in Fig. 7 rests on a horizontal plane for which the coefficient of kinetic friction is 0.3. If the block is pulled by a 350 N force as shown, determine the velocity of the block after it has moved 65 m starting from rest. Use the principle of work and energy.

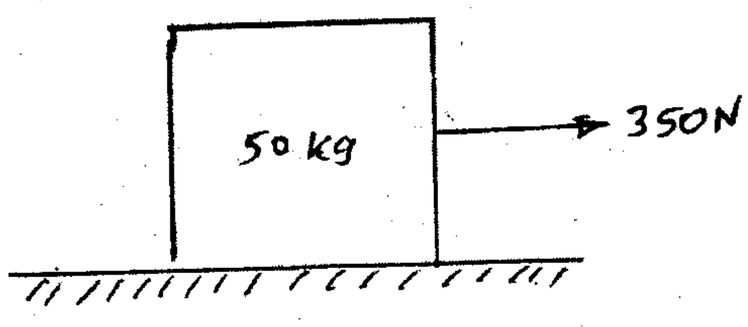

Fig. 7

Or

(b) The 50 kg block shown in Fig. 8 is originally at rest on the smooth horizontal surface. Determine the time needed for the block to attain a velocity of 30 m/s if a force of 300 (N) is acting on the block as shown. Use principle of impulse and momentum.

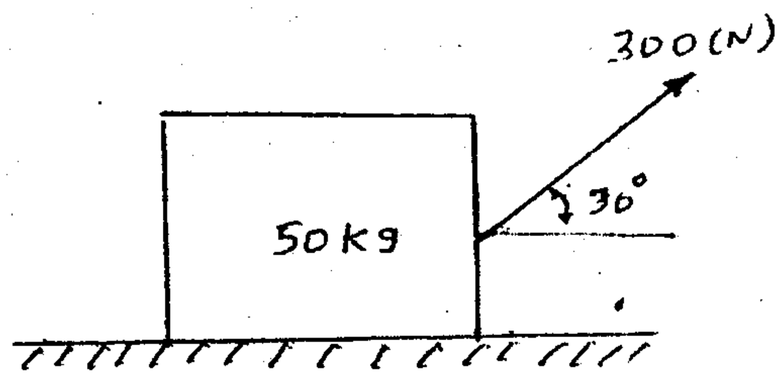

Fig. 8

15. (a) Calculate the static coefficient of friction μ_S between the block shown in Fig. 9 having a mass of 75 kg and the surface. Also, find the magnitude and direction of the friction force if the force P applied is inclined at 45° to the horizontal and $\mu_S = 0.30$.

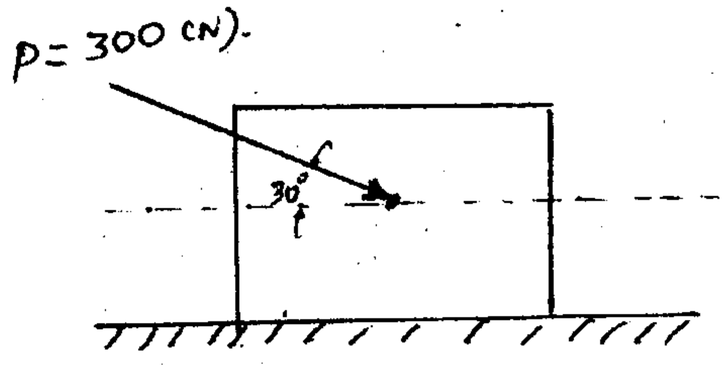

Fig. 9

Or

(b) A body rotates according to the relation $\theta = at^4 + bt^2 + ct$ where a, b and c are constants. Determine the values of the constants a, b and c if the angular coordinate is 20 rad, angular velocity is 20 rad/s and angular acceleration is 16 rad/s² at time $t = 2\ s$.