C 14983 (Pages 3) Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, MAY 2011

EN 04 107 (A)—ENGINEERING MECHANICS (A)

(For CE, AI, CH, CE, CS, EE, EC, IT, IC, BM, BT, PT)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 5 *marks.*

I. (a) State and prove Lami's theorem.

(b) Explain the different types of forces with neat sketch.

(c) State the factors influencing friction.

(d) What are prinicipal axes and principle moments of inertia ?

(e) Define the term 'support reaction'. Describe the analytical as well as graphical methods for finding out the support reactions of a beam carrying vertical loads only.

(f) What is a plane truss ? What are the assumptions made in the analysis of plane trusses ?

(g) State and prove the working energy equation.

(h) State and prove the D'Alembert's Principle.

(8 × 5 = 40 marks)

Part B

II. (a) An automobile is pulled by means of trucks as shown in Figure 1. If the resultant of the two forces acting on the automobile is 25 kN being directed along the positive direction of X-axis, determine the angle θ of the cable attached to the track at B such that the force F_B in this cable is minimum. What is the magnitude of force in each cable when this occurs ?

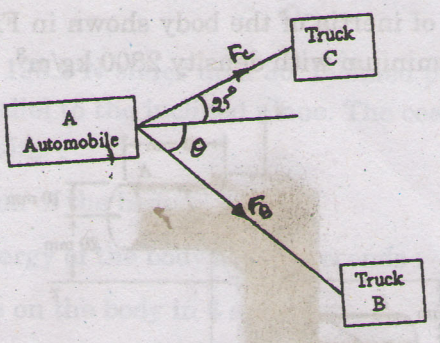


Fig.1.

Or

Turn over

(b) If the tension in wire 'AB' is 75 kN, determine the required values of tensions in 'AC' and 'AD', so that the resultant of the three forces applied at 'A' is vertical as shown in Fig.2. Find also the resultant.

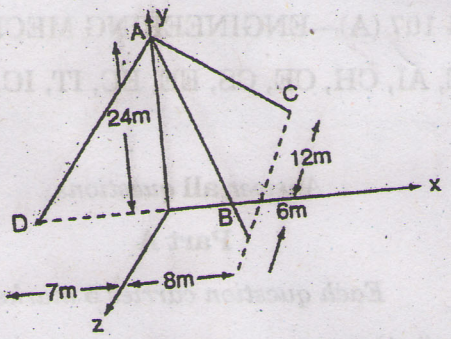


Fig.2.

III. (a) A block of weight W_1 = 1290 N rests on a horizontal surface and supports another block of weight W_2 = 570 N on top of it as shown in Figure 3. Block of weight W_2 is attached to a vertical wall by an inclined string AB. Find the force 'P' applied to the lower block, that will be necessary to cause the slipping to impend. Coefficient of friction between blocks 1 and 2 = 0.25 and coefficient of friction between block 1 and horizontal surface = 0.40.

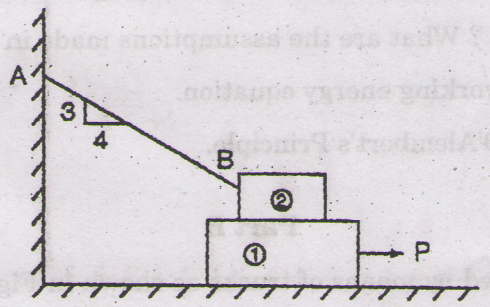


Fig.3.

Or

(b) Find the mass moment of inertia of the body shown in Fig.4. with respect to X and Y axis. The body is made of aluminium with density 2800 kg/m^3.

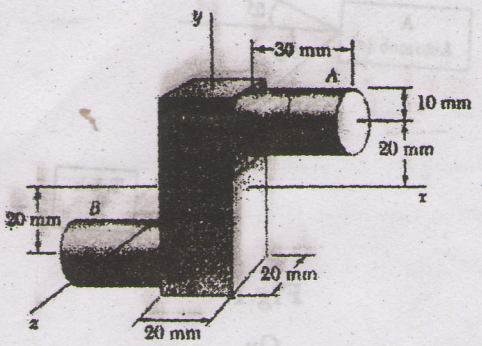
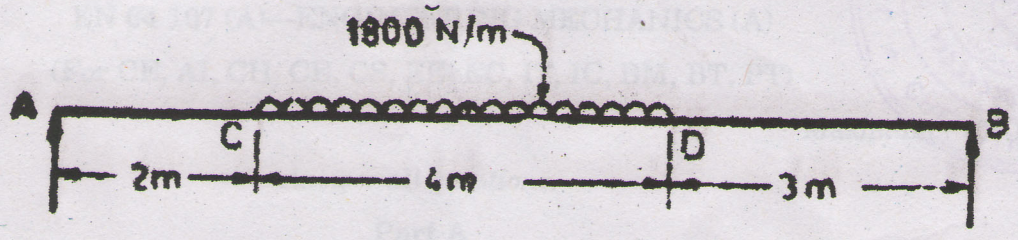


Fig.4.

IV. (a) Draw shear force bending moment diagrams for the simply supported beam shown in Figure.5.



Or

(b) Find the forces in the various members of the frame shown in Figure.6.

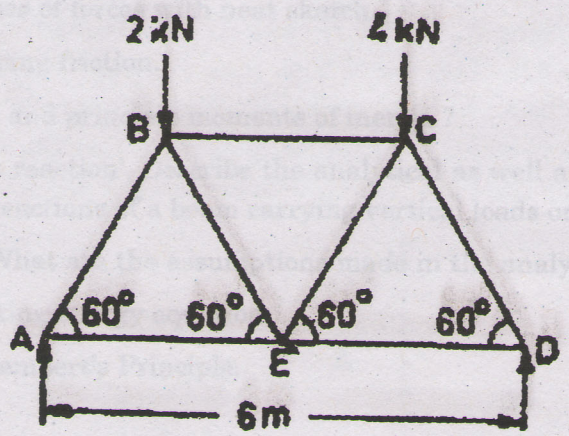


Fig.6.

V. (a) A tower is 90 m. in height. A particle is dropped from the top of the tower and at the same time another particle is projected upward from the foot of the tower both the particle meet at a height of 30 m. Find the velocity with which the second particle is projected upward.

Or

(b) A body weighing 196.2 N slides up a 30° inclined plane under the action of an applied force 300 N acting parallel to the inclined plane. The coefficient of friction is 0.2. The body moves from rest. Determine :

(i) Acceleration of the body ;

(ii) Kinetic energy of the body after 4 seconds ;

(iii) Work done on the body in 4 seconds ;

(iv) Impulse applied in 4 seconds.

(4 × 15 = 60 marks)