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B.E./B.TECH DEGREE EXAMINATIONS: MAY / JUNE 2011

Second Semester

MEC102: ENGINEERING MECHANICS

(Common to Civil, Aeronautical, Mechanical, Mechatronics Engineering, Textile Technology,

Textile Technology (Fashion Technology), Biotechnology)

Time: Three Hours   **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. If three coplanar forces acting at a point be in equilibrium, then each force is proportional to the

   sine of angle between the other two forces. The above statement is a

    A. triangle law of forces   B. parallelogram law of forces

    C. polygon law of forces   D. lame's theorm

2. A single equivalent force which can replace the given force of system for an equivalent effect is a

    A. coplanar force   B. resultant force

    C. concurrent force   D. non concurrent non coplanar force

3. The moment produced by two equal, opposite and non collinear force is known as

    A. couple   B. moment   C. centriod   D. moment of inertia

4. In beam, one end is fixed and other end is free is called as

    A. simply supported beam   B. fixed beam   C. free beam   D. cantilever beam

5. The $\overline{X}$ value of the quadrant is (r – radius of the quadrant)

    A. $2r / 3\pi$ B. $4r / 3\pi$ C. $5r / 3\pi$ D. $r / 3\pi$

6. The point at which the entire area of the figure is assumed to be concentrated is called as

    A. moment of inertia   B. centre of gravity   C. centriod   D. polar moment of inertia

7. Coloumb friction is the friction between the

    A. dry surfaces   B. wet surfaces   C. oil surfaces   D. air surfaces

8. Maximum value of static friction is known as

    A. coefficient of friction   B. cone of friction   C. limiting friction D. angle of friction

9. The study of motion of a moving body with also considering the external forces which cause the

    motion is called as

    A. statics   B. kinetics   C. kinematics   D. rectilinear motion

  10. To every action there is an equal and opposite reaction is a Newton's

    A. first law   B. second law   C. zeroth law   D. third law

PART B (10 x 2 = 20 Marks)

11. State law of parallelogram forces

12. Two forces 3 N and 1 N act on a particle. Determine the resultant when they act at right angles

     to each other and act at 60^0.

13. State any two applications of Varignon's theorm

14. List out any four types of supports

15. State perpendicular axis theorm

16. Write the mathematical definition of polar moment of inertia

17. What is angle of repose in friction?

18. Mention the uses of belt friction

19. State D'Alembert's Principle for plane motion of a rigid body.

20. Differentiate rectilinear and curvilinear motion.

PART C (5 x 14 = 70 Marks)

21. a) A frame supported at A and B is subjected to force of 500 N as shown below fig. 1. Compute the reactions at the support points for the cases of $\theta = 0^0$, $\theta = 90^0$ and $\theta = 0^0$
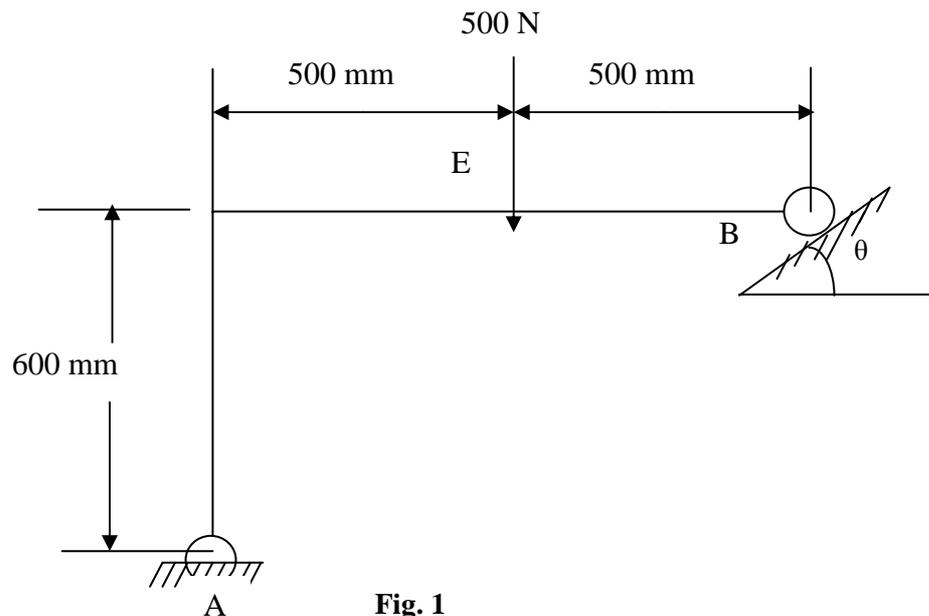
Fig. 1

(OR)

b) In the following fig. 2, it shows two vertical forces and a couple of moment 2000 Nm acting on a horizontal rod which is fixed at end A.. Determine (i) the resultant of the system (ii) an equivalent system through A
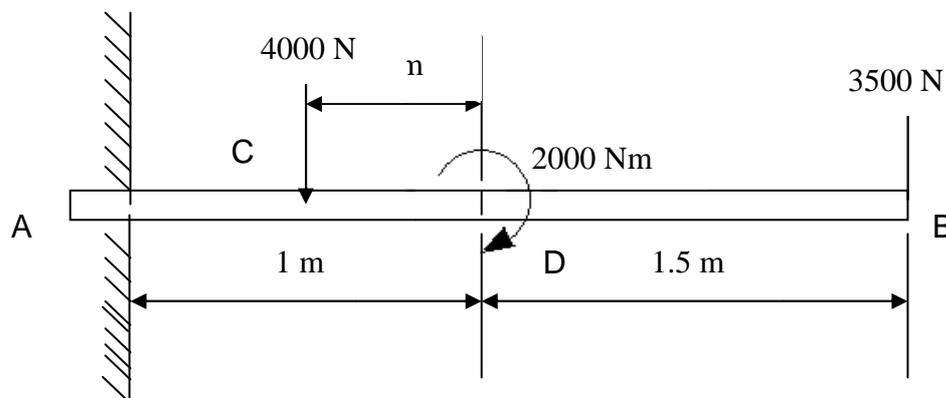
Fig. 2

22. a) In the following fig. 3, (i) find the resultant of the system (ii) find the points of inclination of its line of action with AC and CD. (iii) The 27 N cm couple applied at C is removed and replaced by a couple of unknown magnitude M. Determine the value of M if the resultant force is to pass through C

3 N

9 N

27 N cm

A

B

C

7.5 cm

12.5 cm

7.5 cm

Fig. 3

D

8 N
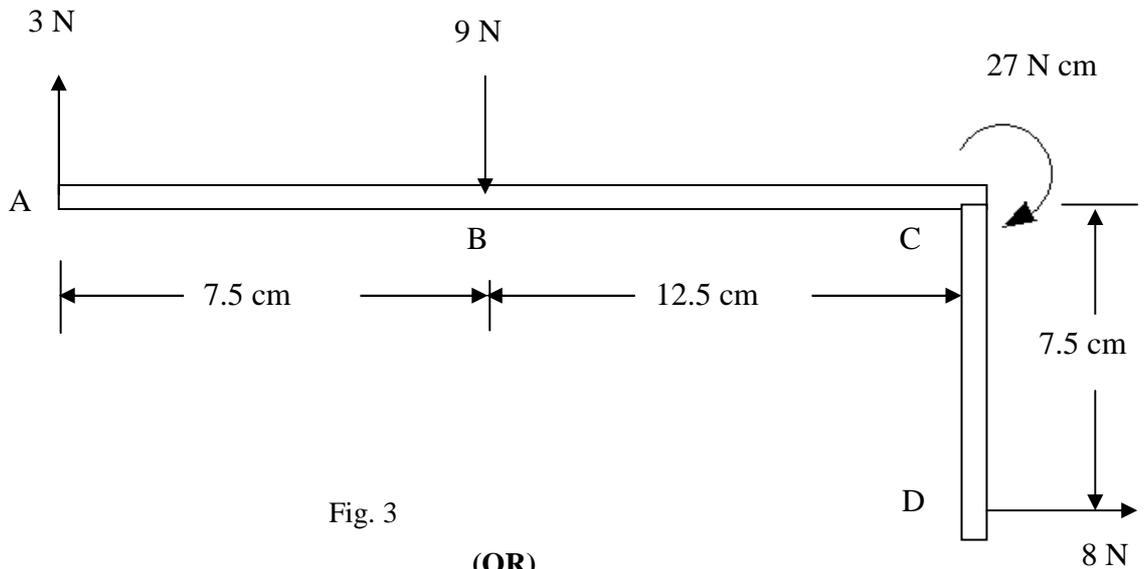
(OR)

b) Find the reactions at the supports of the overhanging beam shown in fig. 4.

60 N

1 m

150 N

20 N/m

A

B

H_A

60^0

C

D

2 m

V_A

5 m

V_B

2 m
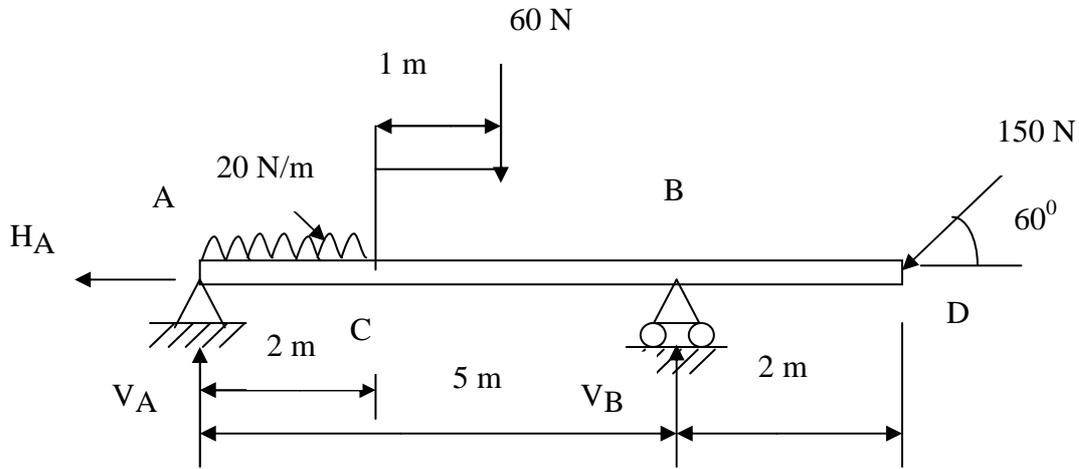
Fig. 4

23. a) Find the moment of Inertia of a channel section, shown in fig. 5

12 mm

140 mm

12 mm

12 mm

Fig. 5

110 mm
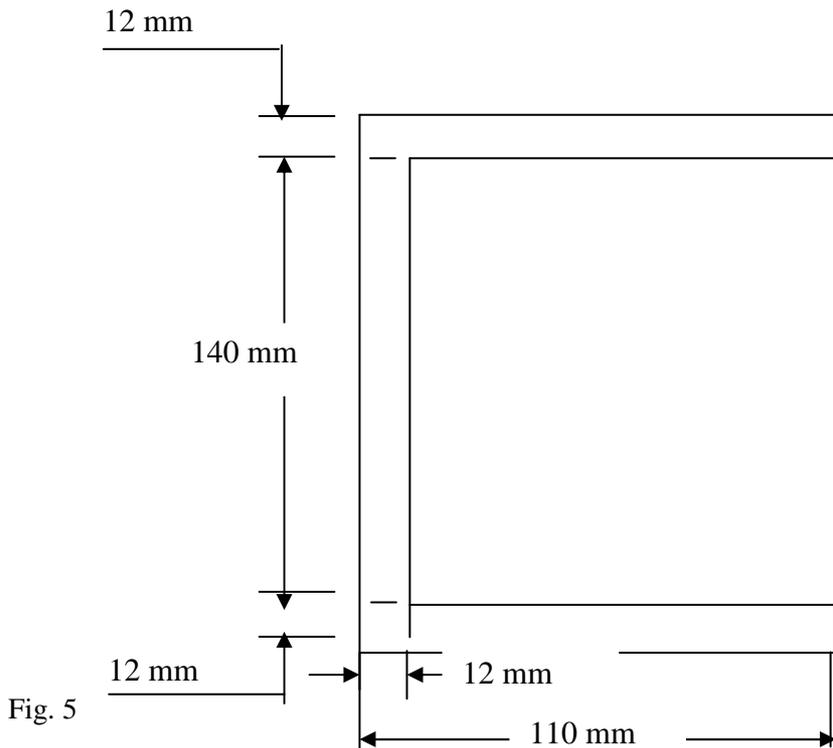
b) Find the moment of Inertia of the section shown in fig. 6 about its horizontal centroidal axis.
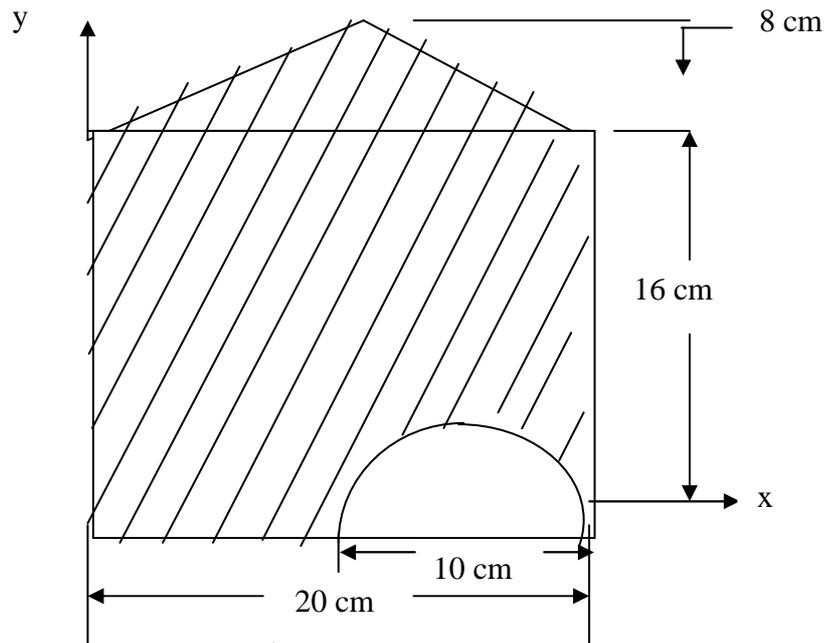
Fig. 6

24. a) In fig. 7, What should be the value of the angle θ so that motion of the 390 N blocks impends down the plane? The coefficient of friction for all surfaces is 1/3.
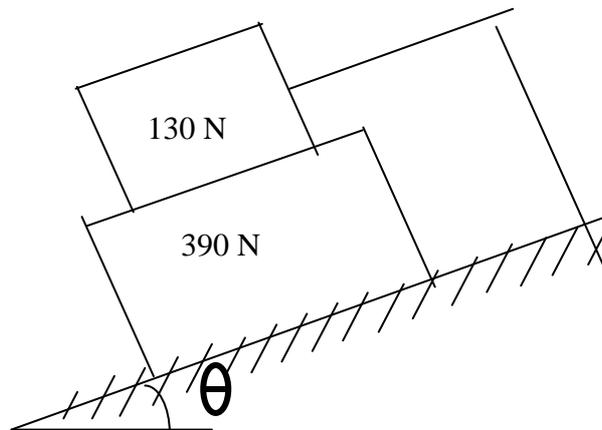
Fig.7

(OR)

b) A 7m ladder rests against a vertical wall, with which it makes an angle of 45^0 and on a floor. If a man whose weight is one half that of the ladder climbs it, at what distance along the ladder will he be, when the ladder is about to slip?. Take coefficient of friction between the ladder and the wall is 1/3 and that between the ladder and the floor is 1/2.

25. a) Two blocks A and B of weight 100 N and 200 N respectively are initially at rest on a 30^0 inclined plane as shown in fig. 8. The distance between the blocks is 6 m. The coefficient of friction the block A and the plane is 0.25 and that between the block D and the plane is 0.15. If they are released at the same time, in what time the upper block (B) reaches the lower block (A).
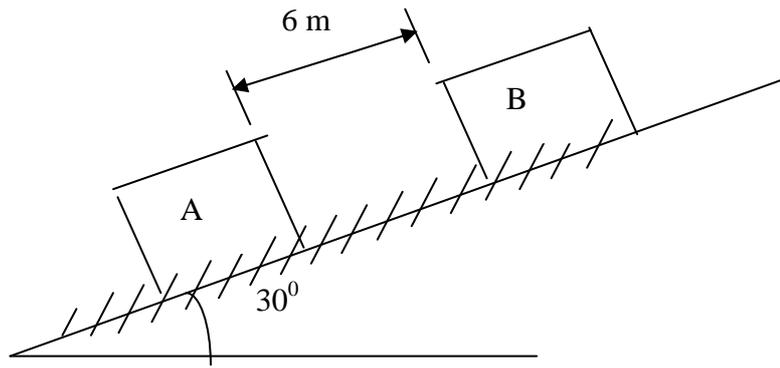
6 m

B

A

30^0

Fig.8

(OR)

b) Two blocks A and B of weight 80 N and 60 N are connected by a string, passing through smooth pulley, as shown in fig. 9. Calculate the acceleration of the body and the tension in the string. Use work energy method.
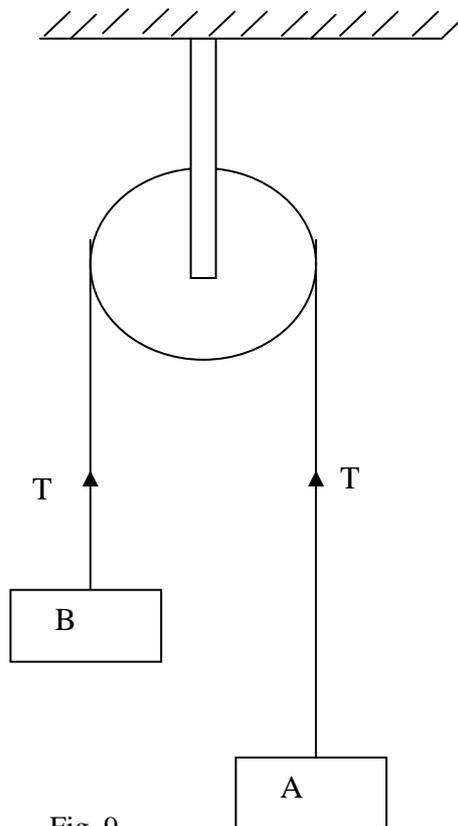

T

T

B

A

Fig. 9

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