[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2068)

18004(J)

B. Tech 1st Semester Examination

Engineering Mechanics (CBS)

ME-101

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each sections A, B, C and D. Section E is compulsory. Assume missing data suitably, if any.

SECTION - A

1. (a) Two identical rollers, each of weight Q=445 N, are supported by an inclined plane and a vertical wall as shown in Fig. 1. Assuming smooth surfaces, find the reactions induced at the points of support A, B and C.

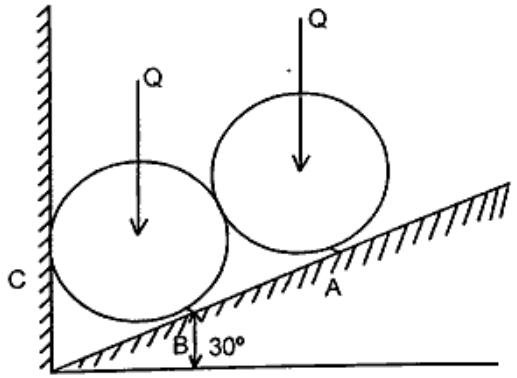

Fig. 1

(b) Distinguish clearly between like forces and unlike forces. Show that if three coplaner forces, acting at a point be in equilibrium, then, each force is proportional to the sine of the angle between the other two. (6+4=10)

2. (a) In the bar AB of square frame ABCD (shown in Fig. 2) a tensile force P is produced by turning a turnbuckle 'T'. Determine the forces and their nature produced in another bars. The diagonal AC and BD pass each other freely at point E.

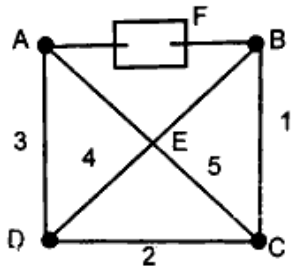

Fig. 2

(b) What are the methods for finding out the resultant force for a given system of forces? Explain. The following forces act at a point :

(i) 20 N inclined at 30° towards North of East,

(ii) 25 N towards North,

(iii) 30 N towards North West and

(iv) 35 N inclined at 40° towards South of West.

Find the magnitude and direction of the resultant froce. (5+5=10)

SECTION - B

3. (a) Define the term "moment of inertia" and Derive an equation for moment of inertia of (i) a circular section about centroidal axis (ii) a hollow rectangular section.

(b) A uniform lamina shown in Fig 3. consists of a rectangle, a circle and a triangle. Determine the centre of gravity of the lamina. All dimensions are in mm (5+5=10)

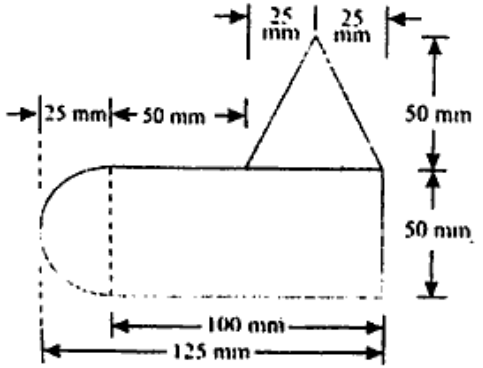

Fig. 3

4. (a) What do you understand by Wedge friction? Explain clearly, why it comes into play? How will you distinguish between static friction and dynamic friction? Explain the concept and importance of lifting machines.

[P.T.O.]

(b) Two identical blocks of weight W are supported by a rod inclined at 45° with the horizontal as shown in Fig. 4. If both the blocks are in limiting equilibrium, find the coefficient of friction (μ), assuming it to be the same at floor as well as at wall. (5+5=10)

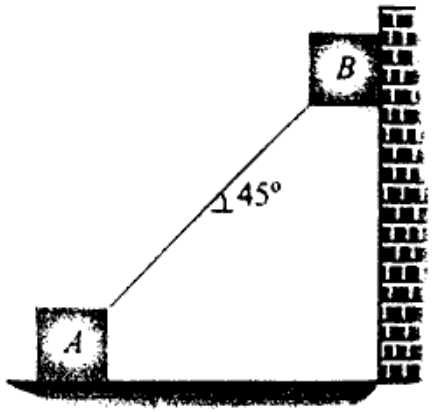

Fig. 4

SECTION - C

5. Check whether truss in the Fig. 5 as stable, unstable, statically determinate, or statically indeterminate. Identify zero-force members and determine all the member forces. (10)

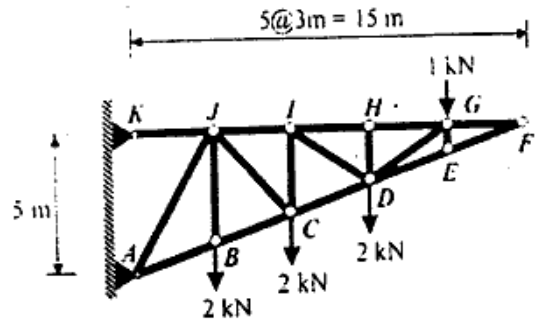

Fig. 5

6. For the beam loaded as shown in Fig. 6 calculate the value of udl w so that B.M at C is 50 KNm. Draw shear and bending moment diagram for the calculated value of w. Locate the point of contra flexure, if any. (10)

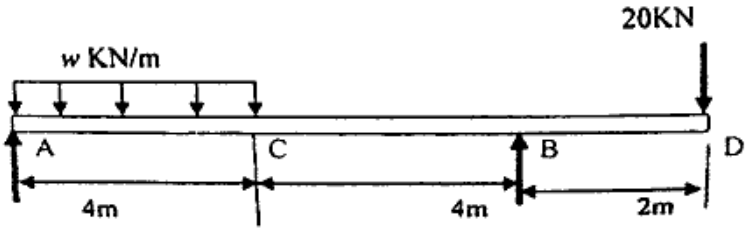

Fig. 6

SECTION - D

7. (a) Using D'Alembert's principle write equations of dynamic equilibrium of a particle in curvilinear motion. State the principle of moment of momentum and Obtain the equation for moment of momentum of a particle A of mass m moving along the curvilinear path in the xy plane defined by equations

x = a cos pt and y = b sin 2pt, where a, b, p are constants. (5)

(b) (i) State D'Alembert's principle in rotation. Explain how will you apply D'Alembert's principle to body in rotation?

(ii) State work energy principle for rotating bodies. Obtain energy equation for rotating bodies. (5)

8. (a) A car weighing 15 KN goes around a flat curve of 50 m radius. The distance between the inner and outer wheel is 1.5m and C.G is 0.75 m above the road level. What is the limiting speed of the car from the consideration of

1. avoiding skidding
2. preventing overturning
3. on a road banked to an inclination of 1 in 10.

Determine the normal reactions developed at the inner and outer wheels if the car negotiates the curve with a speed of 40kmph. Take Coeff of friction = 0.4

(b) Define plane motion of rigid body. Obtain the equations of plane motion of a rigid body. (6+4=10)

SECTION - E

9. (i) What is Routh's rule for finding out the moment of inertia of an area?

(ii) State Varignons theorem.

(iii) State principle of transmissibility of forces.

(iv) State triangle law of forces and polygon law of forces.

(v) State the laws of friction.

(vi) What are statically determinate beams? Give examples.

(vii) Write down work energy equation for curvlinear motion of particle.

(viii) A stone is thrown upwards with a velocity of 4.9 m/s from a bridge. If it falls down in water after 2 s, then find the height of the bridge.

(ix) Write the euqations of relative motion of a particle.

(x) Define angle of repose and cone of friction. (10×2=20)