B.Tech

(SEM. I) THEORY EXAMINATION, 2015-16

ENGINEERING MECHANICS (EME-102)

[Time:3 hours]   [Total Marks:100]

SECTION-A

1   Attempt **all** parts. All parts carry equal marks. Write answer of each part in short.   (10×2=20)

(a) Two forces 60 KN and 20KN act at a point O. The included angle between them is 50°. Find the magnitude and direction of the resultant?

(b) Define force couple system.

(c) Define point of contra-flexure in beam.

(d) Write down the assumptions in truss analysis.

(e) Define product of inertia and area moment of inertia.

(f) Locate centroid of a wire bent in the form of quarter-circular arc.

(g) Define General plane motion with suitable example.

(h) State D, Alembert's principle.

(i) Write down the relation between E, K, G, μ ?

(j) Write down the assumption in pure bending?

SECTION-B

Attempt **any five** questions from this sections.

$(10\times5=50)$

2. Three sphere A, B and C having their diameter 500 mm, 500mm and 800 mm respectively are placed in a trench with smooth side walls and floor as shown in figure.1 The center to center distance of spheres A and B is 600 mm. The weights of the cylinders A, B and C are 4 KN, 4KN and 8KN respectively. Determine the reactions at P,Q,R, and S.
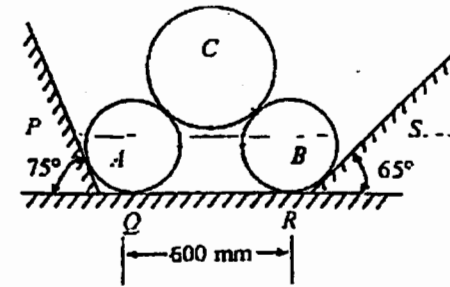

Fig. 1

3. Draw the SFD and BMD for the given beam figure. 2.0. Also find out the position of max BM and point of contra flexure.
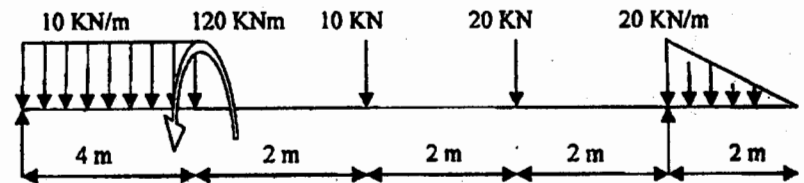

Fig. 2.0

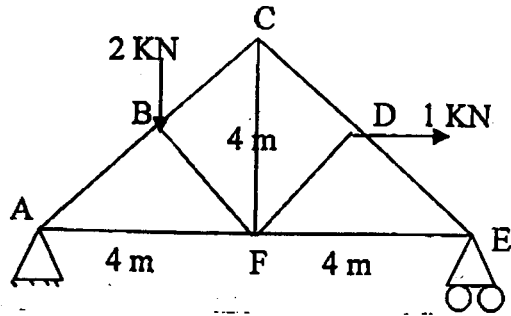4. Find out axial forces in all the members of truss Fig. 3.0.

Fig. 3.0

5. Derive the relation for mass moment of inertia of cylinder about it's transverse centriodal axis.

6. Find out centroid of given section Fig.4.0. Also find out MOI about base. Take X=40mm
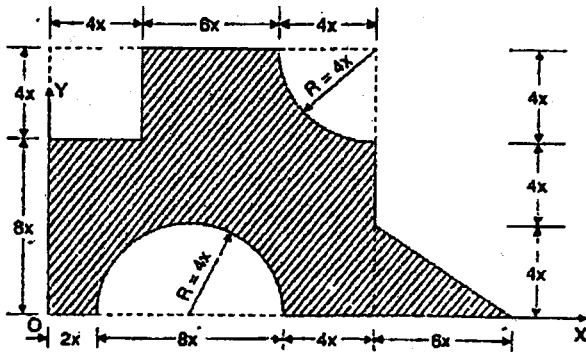

Fig. 4.0

(4)   **EME 102**

7. State work-energy principle. Also describe rotational motion of body.

A car weighing 11 KN and running at 10 m/sec holds three men each weighing 700 N. the men jump off from the back end gaining a relative velocity of 5 m/sec with the car. Find the speed of car if three men jump off(i) all together(ii) in succession.

8. A body weighing 1200N rests on a rough plane inclined at 12° to horizontal. It is pulled by a flexible rope running parallel to the plane and passing over a frictionless pulley. The portion of rope hangs vertically down and carries weight 800N Fig. 5.0. If the coefficient of friction is 0.2 find tension in rope and acceleration with which body moves up.
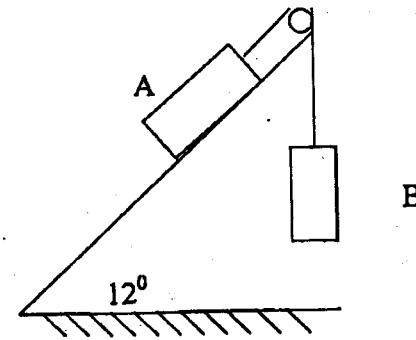

Fig. 5.0

(5)   **P.T.O.**

9. What do you mean by simple and pure bending?

An 80 m long wire of 5 mm diameter is made of steel E=200 GPa ultimate tensile strength is 400 MPa. If factor of safety is 3.2 find out maximum tension and corresponding elongation.

SECTION-C

Attempt **any two** questions from this section.

$(15 \times 2 = 30)$

10. (a) Determine the resultant of four forces tangent to the circle of radius 3 m shown in Fig.6.0. What will be its location with respect to the center of the circle.
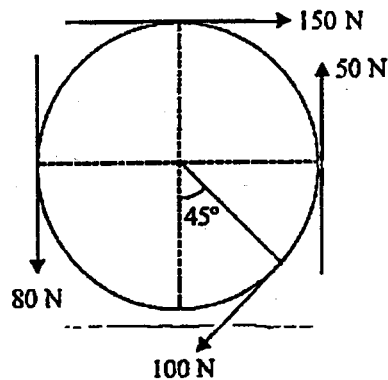

Fig. 6.0

(b) A ladder 7 m long rests against a vertical wall with which it makes an angle of 30° and resting on a floor. If a man whose weight is one half of that ladder, climbs it. At what distance along the ladder will he be when ladder is about to slip? $\mu_s = 0.33$ at wall and 0.5 at floor.

11. (a) A step pulley starts from rest and accelerates by 2 rad/s². Inner radius is 0.6 m and outer radius is 1 m. Two blocks A and B are attached to inner and outer pulley respectively. Find out time required for block A to move 20 m. also find out velocities of both blocks.

(b) A sphere, cylinder and hoop is released from the top of a inclined and rolling. What will be the velocity at the end of inclined plane ?

12. (a) Draw the Stress-Strain diagram for ductile material mild steel under tension and discuss all the salient points.

(b) Determine the dimensions of a simply supported rectangular steel beam 6 m long to carry a brick wall 250 mm thick and 3 m high. If the brick weight is 20 KN/m³ and the maximum stress is 800N/cm². The depth of beam is 1.5 times of it's width.

(c) Define the term Poisson's ratio. Also establish the relation between modulus of elasticity and modulus of rigidity.

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