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Level	BE	Full Marks	80
Programme	BCE, BGE, BME	Pass Marks	32
Year / Part	I / II	Time	3 hrs.

Subject: - Applied Mechanics *(CE451)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What are the equations of Static Equilibrium for 2-D and 3-D analysis of particle and rigid body? [4]

2. Define particle, rigid body and free body diagram. Explain how can we reduce a force into a force and a couple. [3+2]

3. Determine magnitude, direction and line of action of the resultant of forces acting in the system as shown in figure below: [7]
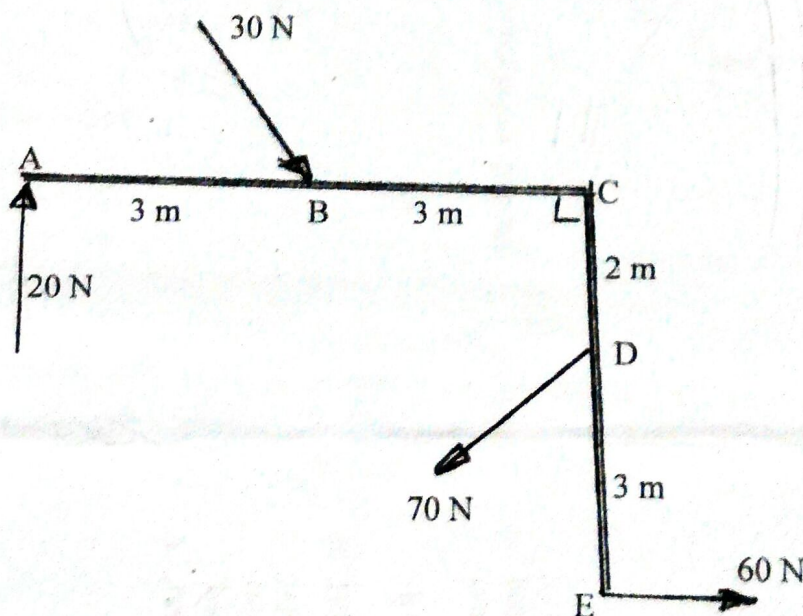

4. Determine the force in each cable and the force 'F' needed to hold the 20 kg lamp in the position shown in figure below: [6]
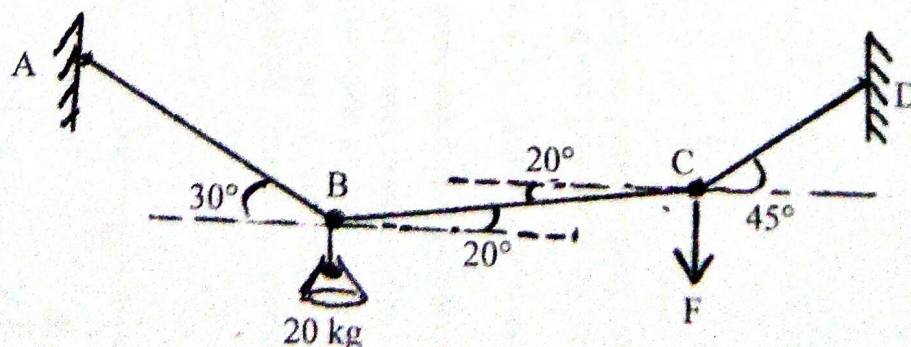
5. Define friction, angle of friction and explain how can we assure the condition of overturning or sliding of a block. [1+2+3]

6. Define centroid, center of gravity and axis of symmetry. Calculate the moment of inertia of the figure below (shaded area) about centroidal X-X axis. [3+9]
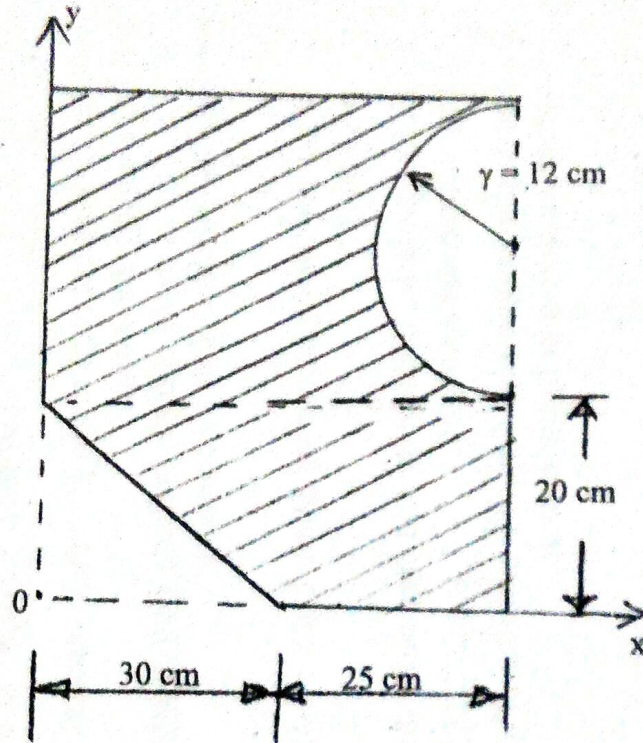
7. Draw AFD, SFD and BMD of the given frame loaded as shown in figure below. Indicate the salient features if any. [13]
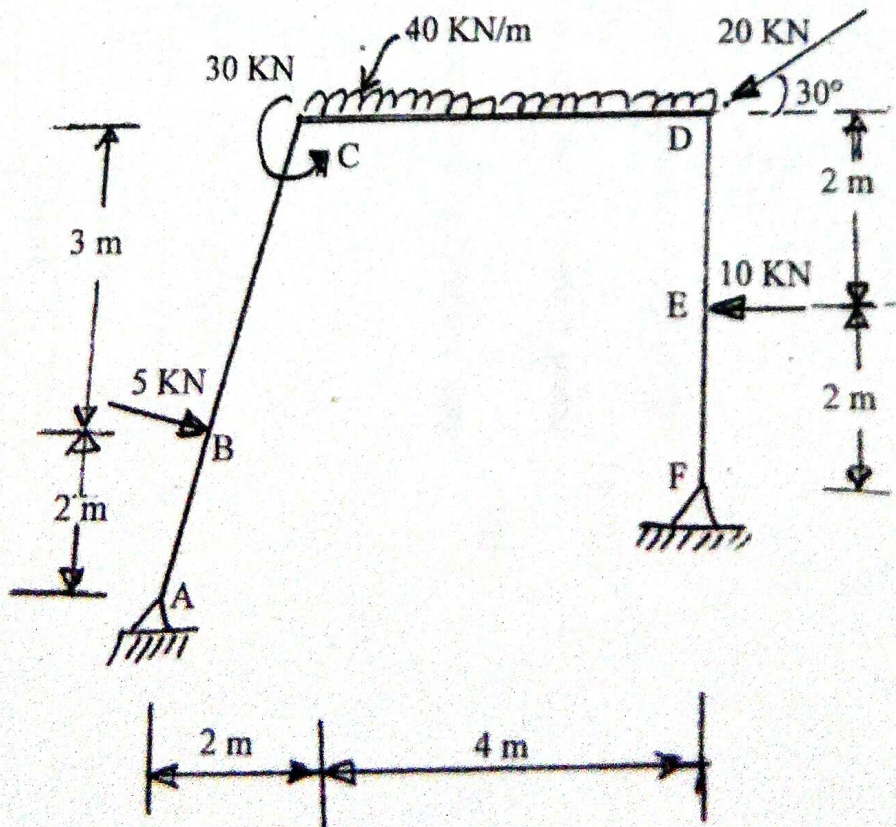
8. Determine the force developed in the members BC, BE, BD and CE of the truss loaded as shown in figure below. What are the assumptions of ideal truss? [5+2]
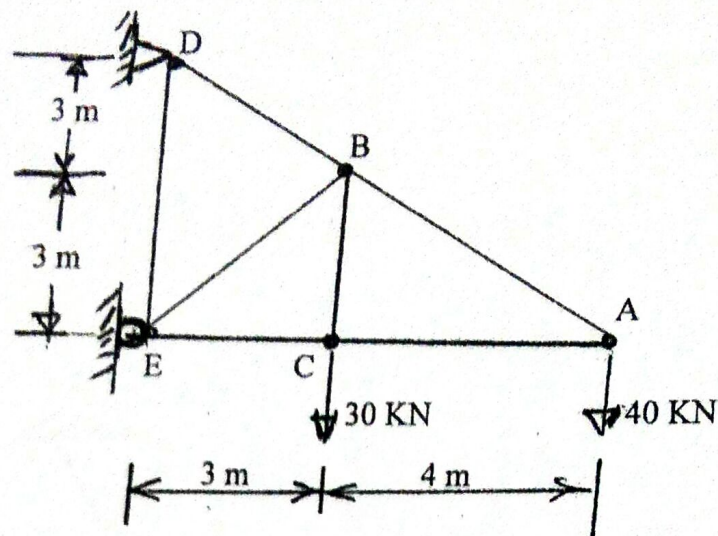
9. The motion of a vibrating particle is defined by the equation $x = 100 \sin \pi t$ and $y = 25 \cos 2\pi t$. Where 'x' and 'y' are expresses in mm and 't' in sec. (a) Determine the velocity and acceleration when $t = 1$ sec (b) Find the nature of the path of the particle. What do you mean by dependent motion explain with example? [8+2]

10. The resultant external force acting on a 3 kg particle in space is

$$\vec{F} = \left(12t\,\hat{i} - 24t^2\,\hat{j} - 40t^3\,\hat{k} \right) N,$$ Where 't' is time measured in seconds. The particle is at rest at origin, when $t = 0$ sec. Determine the 'x' component of acceleration, velocity and position at the instant of 4 sec. Explain about impulse momentum principle of the particle. [8+2]

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