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BTECH
(SEM I) THEORY EXAMINATION 2023-24
ELEMENTS OF MECHANICAL ENGG

TIME: 3HRS

M.MARKS: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

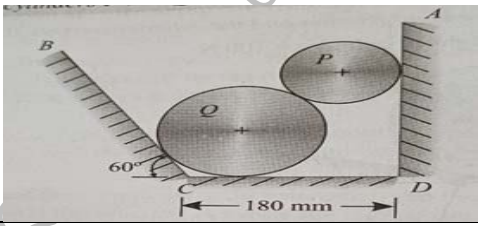
2 x 7 = 14

a.	Explain Condition of equilibrium of coplanar-non concurrent forces.
b.	Define the principle of transmissibility.
c.	Define truss and its types.
d.	Define Poisson's ratio and bulk modulus.
e.	What is zeroth law of thermodynamics?
f.	Define properties of a system.
g.	Define compression ratio and swept volume.

SECTION B

2. Attempt any three of the following:

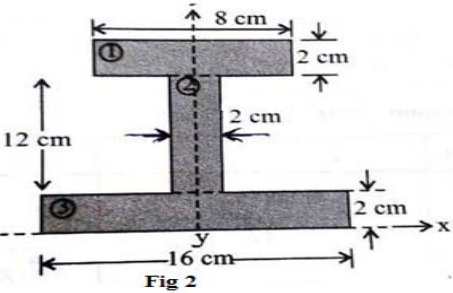
7 x 3 = 21

a.	<p>The cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the box is 180 mm, with one side vertical and the other inclined at 60° determine the reactions at all the point of contacts.</p> 
b.	Describe various types of beams. Draw and explain the SFD and BMD for simply supported beam of length L carrying a point load W at its middle point.
c.	A hollow cast iron cylinder 4 m long, 300 mm outer diameter, and 200 mm inner diameter is subjected to a central load on the top when standing straight. The stress produced is 75000 kN/m^2 . Assume young's modulus for cast iron as $1.5 \times 10^8 \text{ kN/m}^2$ and find (i) magnitude of the load (ii) longitudinal strain produced, and (iii) total decrease in length.
d.	Give the classification of hydraulic turbine. Discuss the construction and working of Pelton turbine.
e.	Discuss the difference between a heat engine, refrigerator and heat pump. Show that the $(\text{COP})_{\text{HP}} = 1 + (\text{COP})_{\text{R}}$.

SECTION C

3. Attempt any one part of the following:

7 x 1 = 7

(a)	<p>Find the moment of inertia of I section shown in figure below about its centroidal x and y axis.</p>  <p style="text-align: center;">Fig 2</p>
(b)	Calculate the tensile force in the cables AB and BC as shown in fig.1. Assume the pulleys to be



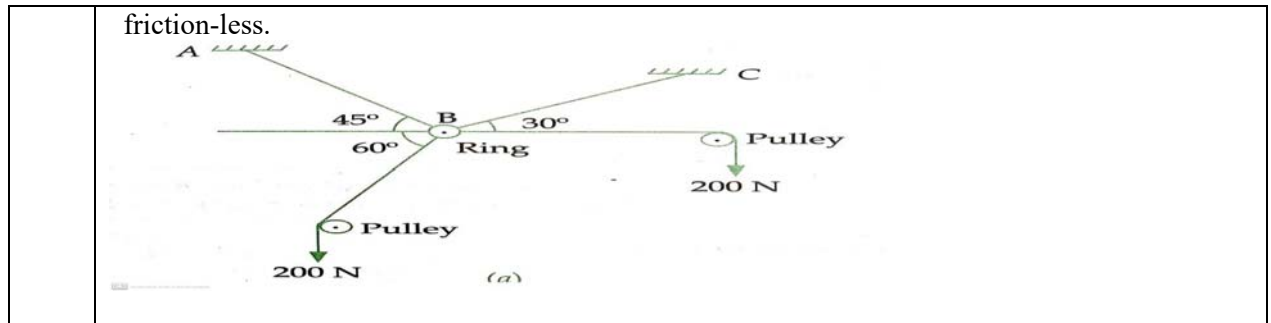
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4. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Draw shear force and bending moment diagram for given beam as shown in fig.
-
- (b) Determine the forces in each member of the truss as shown in figure below.
-

5. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Write the assumptions and prove bending equation.
- (b) Write short notes:
(i) Ferrous and Non-Ferrous materials
(ii) Composite material

6. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Explain Microscopic and macroscopic approach. Discuss quasi-static process in detail. Differentiate between heat and work.
- (b) Discuss first law of thermodynamics and its limitations.

7. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Discuss Carnot cycle in detail, also write Carnot theorem.
- (b) Explain the working of 4 stroke S.I. engine with neat sketch.