



I SEMESTER B.TECH. (ALL BRANCHES)
END SEMESTER EXAMINATIONS, DEC 2019
SUBJECT: MECHANICS OF SOLIDS [CIE 1051]
REVISED CREDIT SYSTEM
 (/ 12 / 2019)

Time: 3 Hours

MAX. MARKS: 50

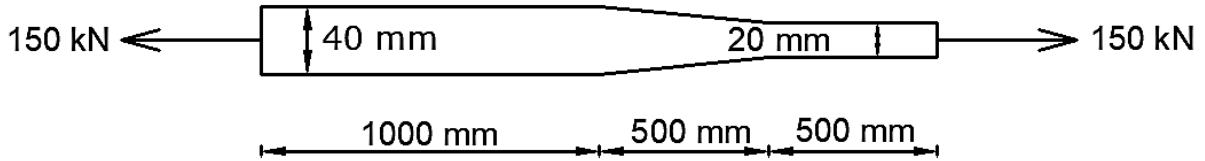
Instructions to Candidates:

- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

Q. No		M	CO
1A.	<p>Locate the resultant of coplanar non-concurrent force system shown in figure with respect to 'A'.</p>	4	1
1B.	<p>Two cables tied together at C are loaded with a weight $W = 190\text{ N}$ as shown in figure. Determine the tension in the cable AC and BC to maintain equilibrium.</p>	2	2
1C.	<p>Two blocks A and B are resting against a wall and the floor as shown in figure. Find the minimum value of horizontal force P applied to the resist the motion of the block A. Given coefficient of friction between all contact surfaces is 0.2.</p>	4	2

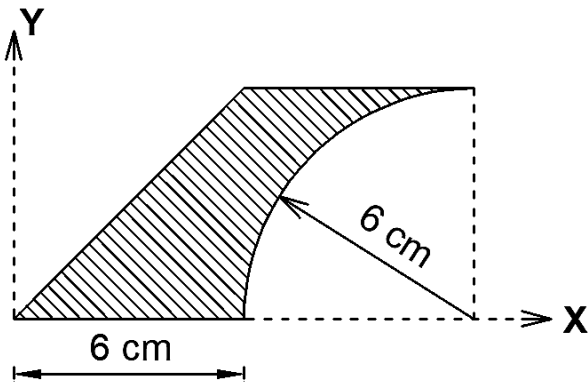


2A.	<p>A steel bar 400 mm in length elongates by 10 mm under axial tensile load of 360 kN. Considering Poisson's ratio as 0.3 and Modulus of Elasticity = 2×10^5 N/mm². Find original diameter and final diameter of bar.</p>	3	4
2B.	<p>Determine the second moment of area with respect to given reference axis AB for the shaded region.</p>	5	3
2C.	With a neat sketch distinguish between space diagram and free body diagram.	2	2
3A.	<p>A two meter long steel bar is having uniform diameter of 40 mm for a length of 1 m, in the next 0.5 m its diameter gradually reduces to 20 mm and for remaining 0.5 m length diameter remains 20 mm uniform as shown in the figure. If a load of 150 kN is applied at the ends, find the stress in each section and total extension of the bar. Take $E = 200$</p>	4	4



3B.

Locate the centroid with respect to the given axes shown in the figure for the shaded region.



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3C.

Derive second moment of area of a rectangle about horizontal centroid axis using first principle.

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4A.

Explain the state of simple shear.

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4B.

At a point in a thin cylinder subjected to internal fluid pressure, the value of hoop strain is 600×10^{-4} (tensile). Compute the hoop and longitudinal stresses. How much is the percentage change in the volume of the cylinder? Take $E=200$ GPa and $\mu = 0.28$.

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4C.

Derive the relationship between modulus of elasticity (E), bulk modulus (K) and Poisson's ratio (μ).

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5A.

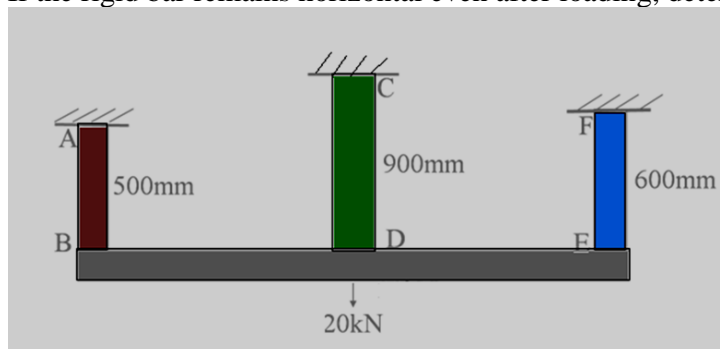
Three vertical rods AB, CD, EF are hung from rigid supports and connected at their ends by a rigid horizontal bar. The rigid bar carries a vertical load of 20 kN. Details of the bars are as follows:

Bar AB :- $L=500$ mm, $A=100$ mm², $E=200$ GPa

Bar CD:- $L=900$ mm, $A=300$ mm², $E=100$ GPa

Bar EF:- $L=600$ mm, $A=200$ mm², $E=200$ GPa

If the rigid bar remains horizontal even after loading, determine the stress and elongation in each bar.



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5B.

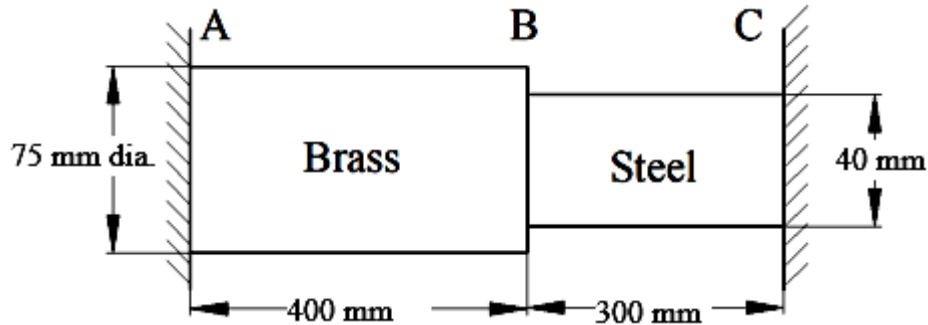
A compound bar of circular cross section consists of a brass portion AB and steel portion BC fixed between two rigid supports as shown in figure. If the temperature is increased by 140°C ,

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find the stress in each segment and change in length of segment AB. Consider $E_{br} = 85 \text{ GPa}$; $\alpha_{br} = 20 \times 10^{-6} / ^\circ\text{C}$ and $E_{st} = 210 \text{ GPa}$, $\alpha_{st} = 11 \times 10^{-6} / ^\circ\text{C}$.



5C.

Explain the following terms with a suitable sketch wherever necessary:

i) Temperature stress ii) Temperature strain

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