



B.E DEGREE EXAMINATIONS: NOV/DEC 2022

(Regulation 2018)

Third Semester

AERONAUTICAL ENGINEERING

U18AEI3203: Mechanics of Solids

COURSE OUTCOMES

CO1:	Solve the problems on structural members subjected to Uni-axial load.
CO2:	Construct Shear Force, Bending moment and Bending stress distribution in beams subjected to transverse load.
CO3:	Determine the deflection of statically determinant beam.
CO4:	Solve the problems on torsion Circular Shafts.
CO5:	Solve the problems on 2d structural element.
CO6:	Demonstrate the experiments with UTM and Determinate Beam structures to determinate.

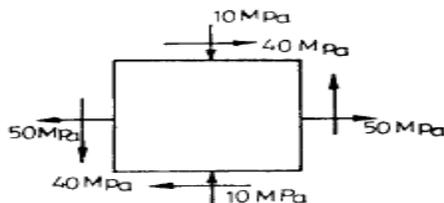
Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

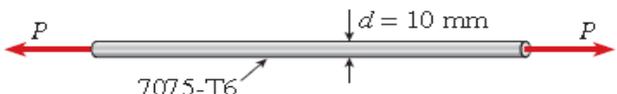
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

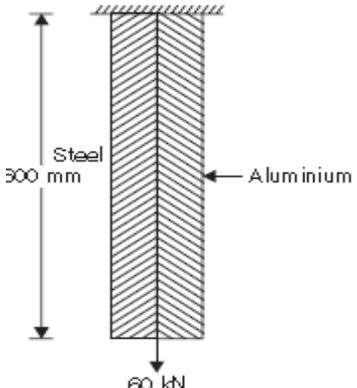
1.	State Hooke's Law.	CO1	[K ₁]
2.	Define: (i) Proof resilience (ii) Modulus of Resilience	CO1	[K ₁]
3.	State the assumptions in the theory of simple bending.	CO2	[K ₂]
4.	How do you find the point of contraflexure?	CO2	[K ₂]
5.	Note down the boundary conditions for a simply supported beam subjected to mid-point load.	CO3	[K ₃]
6.	List various methods to find deflection.	CO3	[K ₁]
7.	Write torsional equation and explain each term.	CO4	[K ₂]
8.	Show that 25% of weight reduction is possible when a solid shaft is replaced with hallow shaft, if the internal diameter of the hallow shaft is half of its outer diameter.	CO4	[K ₃]
9.	Find maximum and minimum principal stresses for the figure shown below.	CO5	[K ₃]

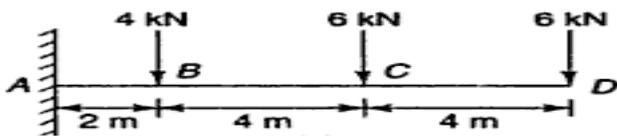


10.	Draw Mohr's circle for a 2-dimensional stress field subjected to (a) Pure shear (b) Pure biaxial tension.	CO5	[K ₃]
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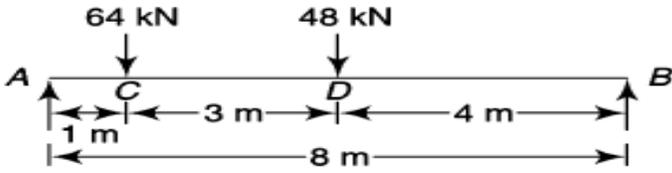
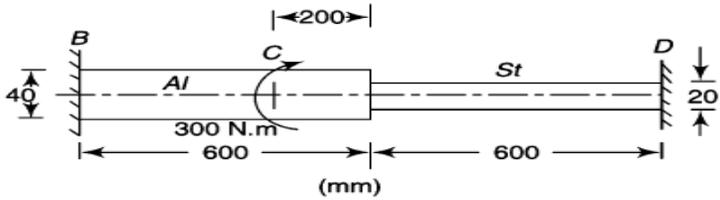
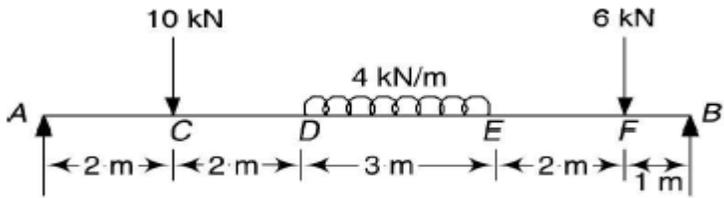
**Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)**

11.	a)	<p>A round bar of 10 mm diameter is made of aluminium alloy 7075-T6 (see figure). When the bar is stretched by an axial force P, its diameter decreases by 0.016 mm.</p> <p>Find the magnitude of the load P. Take: $E = 72 \text{ GPa}$, $\nu = 0.33$, Yield stress $\sigma_Y = 480 \text{ MPa}$.</p> 	6	CO1	[K ₃]
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	b)	<p>A compound bar of length 600 mm consists of a strip of aluminium 40 mm wide and 20 mm thick and a strip of steel 60 mm wide \times 15 mm thick rigidly joined at the ends as shown in figure below. If elastic modulus of aluminium and steel are $1 \times 10^5 \text{ N/mm}^2$ and $2 \times 10^5 \text{ N/mm}^2$, determine the stresses developed in each material and the extension of the compound bar when axial tensile force of 60 kN acts.</p> 	10	CO1	[K ₄]
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12.		<p>A cantilever beam is loaded as shown in figure. Draw the shear force and bending moment diagrams.</p> 		CO2	[K ₃]
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13.		<p>A simply supported beam of 8m length carries two point loads of 64 kN and 48 kN at 1m and 4m respectively from the left end as shown in figure. Find the deflection under each load and the maximum deflection. Take: $E = 210 \text{ GPa}$, and</p>		CO3	[K ₄]
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		$I = 180 \times 10^6 \text{ mm}^4$. 			
14.	a)	<p>A shaft transmits 280 kW of power at 160 rpm. Determine:</p> <p>(i) The diameter of a solid shaft to transmit the required power</p> <p>(ii) The inner and outer diameters of a hollow circular shaft if the ratio of the inner to the outer diameter is (2/3)</p> <p>(iii) The percentage saving in the material on using a hollow shaft instead of a solid shaft.</p> <p>Take the allowable stress as 80 MPa and the density of material 78 kN/m^3.</p>	12	CO4	[K ₃]
	b)	<p>A stepped shaft fixed at the two ends as shown in figure below is subjected to a torque of 300 Nm at the section C. the larger section is of aluminium and the smaller one is of steel. Determine the maximum stresses in the two materials.</p> <p>$G_s = 82 \text{ GPa}$ and $G_a = 27 \text{ GPa}$.</p> 	4	CO4	[K ₃]
15.		<p>The stresses on two perpendicular planes through a point in a body are 30 MPa and 15 MPa both tensile along with a shear stress of 25 MPa. Find</p> <p>(i) The magnitude and direction of principal stresses</p> <p>(ii) The planes of maximum shear stress</p>		CO5	[K ₄]
16.		<p>A simply supported beam is loaded as shown in figure. Draw the shear force and bending moment diagram.</p> 		CO2	[K ₃]
