BT SH-IV(R)-04-22-0725 Reg. No. | | | | | | | | |

A

B.Tech. Degree IV Semester Regular Examination in Naval Architecture and Ship Building April 2022

20-215-0404 ANALYSIS OF STRUCTURES

(2020 Scheme)

Time: 3 Hours Maximum Marks: 100

Course Outcome
On successful completion of the course, the students will be able to:

CO1: Apply principles of elasticity and plasticity for statically indeterminate structures.
CO2: Analyse the stability of columns and structural behaviour of beam column.
CO3: Understanding vibration of continuous structures with practical applications.
CO4: Analyse one dimensional and two dimensional structures using matrix methods of structural analysis.
CO5: Apply FEM principles to solve elastic bodies subjected to mechanical loadings.

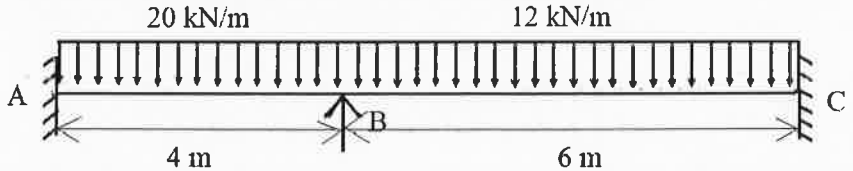
Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create
PO - Programme Outcome

PART A
(Answer *ALL* questions)

			Marks	BL	CO	PO
I.		(5 × 4 = 20)				
	(a)	Write the expression for Generalized Hooke's Law of a linear elastic material model and also explain the stress-strain relationship for an isotropic material.	4	L1	1	1
	(b)	State the principle of minimum potential energy. Also explain with neat sketches the equilibrium states of a rolling ball.	4	L1	2	1
	(c)	Write short notes on: (i) Vibration of discrete systems (ii) Vibration of continuous systems.	4	L1	3	4
	(d)	Explain direct stiffness method of matrix structural analysis.	4	L1	4	3
	(e)	Explain in brief the concept of Finite Element Method and outline the general steps involved in FEM.	4	L1	5	2

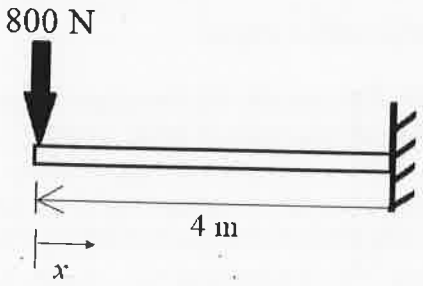
PART B
(5 × 16 = 80)

			Marks	BL	CO	PO
II.	(a)	Write the strain-displacement relationship in continuum mechanics. The state of strain at a point is given by $\varepsilon_x = 0.01$; $\varepsilon_y = 0.03$; $\varepsilon_z = 0.05$ $\gamma_{xy} = 0.024$; $\gamma_{yz} = 0.016$; $\gamma_{xz} = 0.030$. Determine the three principal strains. Also find the directions of the major principal strain.	16	L3	1	1
		OR				
III.		A continuous beam ABC fixed at A and C and simply supported at B consists of spans AB and BC of length 4 m and 6 m respectively. The span AB carries a UDL of 20 kN/m, while span BC carries UDL of 12 kN/m. Find the moments and reactions at the supports.	16	L3	1	1

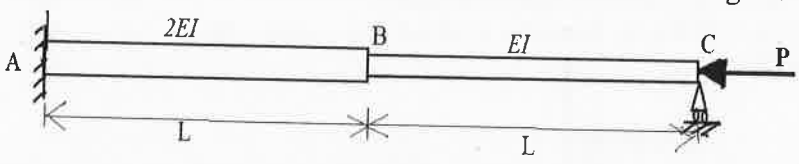


(P.T.O)

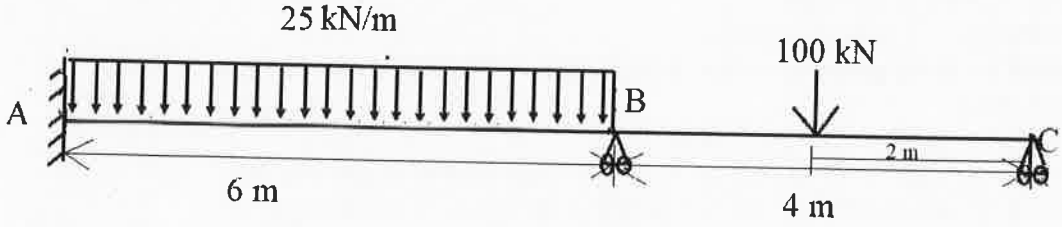
IV.	Derive the Euler's crippling load for the column with both ends pinned. Also, find the buckling load of a round steel rod of diameter 15 mm and length 2 m subjected to a gradually increasing axial compressive load. (Assume Young's modulus, $E = 210\ GPa$)	16	L2	2	3
	OR				
V. (a)	Derive the expression for strain energy stored in a beam subjected to bending.	8	L2	2	3
(b)	For the cantilever beam shown in figure, determine the strain energy stored and the deflection of the beam.	8	L2	2	3



VI.	A vibrating system is defined by the following parameters: m = 3 kg, k = 100 N/m, c = 3 Ns/m. Determine: (i) the damping factor (ii) natural frequency of the damped vibration (iii) logarithmic decrement (iv) ratio of two consecutive amplitudes (v) number of cycles required to reduce the original amplitude by 20 percent.	16	L2	3	4
	OR				
VII.	Derive the equation of motion for transverse vibrations of strings. Give a detailed interpretation of mode shapes (harmonics) of the free vibration of a string with both ends fixed.	16	L2	3	5
VIII.	Find the global stiffness matrix for the beam column shown in figure.	16	L3	4	7



	OR				
IX.	Find the stiffness matrix for the continuous beam with spans AB and BC of flexural rigidity 2EI and EI, respectively	16	L3	4	7



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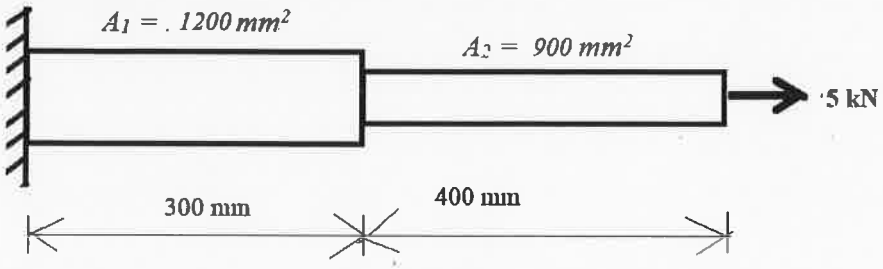
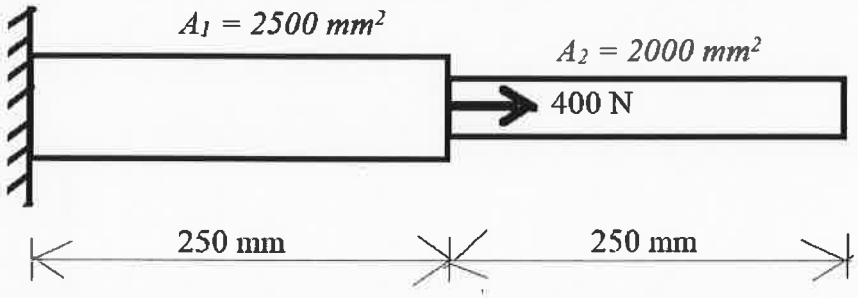
X.	Consider the stepped bar shown in the figure below, develop the global stiffness matrix and determine the nodal displacements and stresses. Assume The Young's modulus, E = 70 GPa.	16	L4	5	7



OR

XI.	The structure shown in the figure consists of two bars. An axial load of P = 400 N is loaded at the mid-span. The Young's modulus, $E = 2.1 \times 10^5$ N/mm^2. Determine the nodal displacements and stress in each bar.	16	L4	5	7



Bloom's Taxonomy Levels
L1 – 20%, l2 – 32%, L3 – 32%, L4 – 16%

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