BT SH-IV(R/S)-04-23-2409 Reg. No. | | | | | | | | |

C

B.Tech. Degree IV Semester Regular/Supplementary Examination in Naval Architecture and Ship Building April 2023

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)

		(5 × 4 = 20)	Marks	BL	CO	PO
I.	(a)	How would you describe idealization of load bearing structures? Give two examples with figures.	4	L2	1	1,2, 3,7, 12
	(b)	What are the different types of buckling which can arise in beams?	4	L1	2	1,2,3
	(c)	How is vibration of continuous systems different from that of discrete systems?	4	L2	3	1,2, 3,4,5
	(d)	What is a stiffness matrix? Describe how do you interpret a stiffness matrix.	4	L2	4	1,2, 3,4,5, 7,12
	(c)	What do you mean by an active degree of freedom in the context of finite element model of a structure? Use appropriate figure to emphasise.	4	L1	5	1, 2, 3, 4, 5, 7, 12

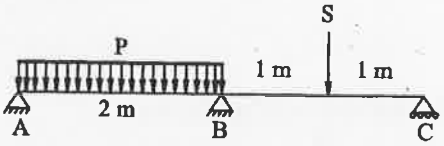
PART B

		(5 × 16 = 80)				
II.	(a)	What is a shape factor in the context of plastic analysis? Demonstrate how would you calculate the shape factor of a rectangular section.	8	L2	1	1,2, 3,7, 12
	(b)	Consider the case of structural analysis of a sea going vessel. Explain in detail the various types of loads, a typical structure would have to be analyzed while designing.	8	L2	1	1,2, 3,7, 12

OR

(P.T.O.)

			Marks	BL	CO	PO
III.	(a)	Demonstrate how you would analyse the continuous beam under the loads as shown in the figure. Draw the bending moment and shear force diagrams. Note: Use Three Moments Equation or Moment Distribution Method. Uniformly distributed load P is 30 kN/m and the point load S is 100 kN.	10	L4	1	1, 2, 3, 7, 12



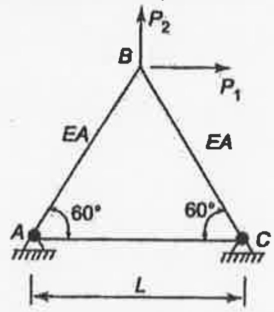
			Marks	BL	CO	PO
	(b)	How would you adapt the Three Moments Equation to analyse a beam whose both ends are fixed? With a figure describe the steps.	6	L2	1	1,2,3, 7,12
IV.	(a)	How would you demonstrate the formulation of governing differential equation of a long slender column subjected to axial force, P?	8	L1	2	1,2,3
	(b)	How would you explain the concept of effective length in the Euler's Theory of Long Column Buckling? Describe the different cases resulting from various combinations of column end conditions. Draw appropriate figures.	8	L1	2	1,2,3
		OR				
V.		What is a beam-column? How would you demonstrate the formulation of the governing differential equation of a beam-column subjected to axial load P and a generalized lateral loading of $q(x)$ where x is the position along the length of the beam-column? Use the approach of equilibrium.	16	L2	2	1,2,3
VI.	(a)	How would you describe about the modes of vibration and the associated natural frequencies of a beam?	8	L2	3	1,2, 3,4,5
	(b)	Demonstrate how you would formulate the governing differential equation of a beam in the context of its lateral vibration.	8	L3	3	1,2, 3,4,5
		OR				
VII.	(a)	How does the torsional modes of vibration affect the performance of a shaft? Explain in detail with figures about a practical application.	8	L3	3	1,2, 3, 4,5
	(b)	Demonstrate how you would formulate the governing differential equation of a rod (or a bar) in the context of its axial vibration.	8	L3	3	1,2,3, 4,5
VIII.	(a)	How would you compare stiffness method and flexibility method of structural analysis?	8	L2	4	1,2, 3,4,5, 7,12
	(b)	How would you show the internal forces with figures of a truss element and beam element?	8	L2	4	1,2,3, 4,5,7, 12

OR

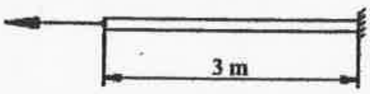
(Continued)

BT SH-IV(R/S)-04-23-2409

			Marks	BL	CO	PO
IX.	(a)	Given here is a truss with the applied forces P1 and P2. Consider the axial deformation of the members and demonstrate how you would derive the flexibility matrix of the structure. The members have the EA constant. Detail the steps in the process.	10	L3	4	1,2,3, 4,5,7, 12



			Marks	BL	CO	PO
	(b)	How would you explain the relation between flexibility matrix and the stiffness matrix of the structure?	6	L3	4	1,2,3, 4,5,7, 12
X.	(a)	How would you identify the degrees of freedom of the structure shown in the figure? Consider discretising the structure in to three elements. Use two noded bar element with one axial degree of freedom at each node. The structure is an axially loaded bar with the right most end fixed and there is a tip load P.	6	L4	5	1,2,3, 4,5,7, 12

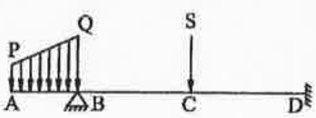


			Marks	BL	CO	PO
	(b)	Demonstrate how you would determine the nodal displacement of the structure shown in the figure. Discretize in to three elements of equal length of 1m, the tip load is 20 kN, the material Young's Modulus is 2E5 MPa and cross section area is 30 cm^2.	10	L4	5	1,2,3, 4,5,7, 12

OR

			Marks	BL	CO	PO
XI.	(a)	How do you demonstrate the setting up of the generalized eigen value problem for evaluating the natural frequencies and mode shapes of a structure?	8	L3	5	1,2,3, 4,5,7, 12
	(b)	The element stiffness matrix of a beam element is as given below. Setup the global stiffness matrix of active degrees of freedom alone, for the structure shown in figure. Discretise in to two elements AB and BD. Length of AB shall be taken as half the length of BD. Consider all the elements having same EI.	8	L3	5	1,2,3, 4,5,7, 12

$$k^e = EI/L^3 \begin{bmatrix} 12 & 6L & -12 & 6L \\ 6L & 4L^2 & -6L & 2L^2 \\ -12 & -6L & 12 & -6L \\ 6L & 2L^2 & -6L & 4L^2 \end{bmatrix}$$



Bloom's Taxonomy Levels

L1-20%, L2-30%, L3-30%, L4-20%.

***