Ex/CE/PE/B/T/422B/2025

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM - 2025

ADVANCED STRUCTURAL ANALYSIS AND DESIGN

PART-I

Time: Three Hours | Full Marks 100 (50 marks for 2nd part)

Use a separate Answer-Script for each part

[Any IS codes or handbook are allowed]

No. of questions	Part I (any 3 from 1-4, and any one from 5-6)	Marks (50)
1)	Write a short note on application of reliability analysis in structural design.	10
2	2) A Fe 250 steel section made of Fe 250 steel is suggested to carry an applied deterministic bending moment of 40 kNm. The nominal yield stress F_y of the steel is 250 MPa, and the nominal plastic modulus of the section Zp=496.77cm^3. Consider that the distributions of these random variables are unknown; only the means, standard deviations, and COVs are known: $\mu_{F_y} = 300\ MPa.$, $\sigma_{F_y} = 30\ MPa.$ μ_z = 500 cm^3, 6_z =25 cm^3, Assume that F, and Z are statistically independent. Determine reliability index by MVFOSM method.	10
3	Suppose a cable of resistance R needs to carry a weight S. Assume both R and S are normal random variables with means of 110 kN and 50 kN, respectively, and corresponding standard deviations of 18 kN and 12 kN, respectively. The limit state equation can be assumed as Z=R-S. Prove that, the safety index according to the MVFOSM and the Hasofer-Lind methods will be the same.	10
4)	A simply supported steel beam with a 4.5 m span has been designed to carry a dead load of 3 kN/m and a live load of 2.5 kN/m UDL. The beams are spaced 3.5 m apart and are continuously laterally supported by the concrete slab. Using Fe250 steel an engineer suggests a steel section of ISMB 250. Based on the preceding discussion, what will be the corresponding resistance and load factors? assume that the uncertainties in the dead load and live load in terms of COV are 0. 13 and 0.37, respectively. The uncertainty in the resistance of the steel section, considering the uncertainties in material properties, fabrication, and modeling, is 0.13. These COVs are typical values reported in the literature. Consider first that all the variables are normal random variables, Zp=496.77cm^3. Assume any other suitable data.	10
5)	Determine and design side walls and hopper bottom of square bunker of storing 80 tons of cement having density 14kN/m^3 and angle of repose is 22°. Adopt M30 grade of concrete and Fe 500 steel.	20
6)	Analyze and design a rectangular silo having 16m length and 8m width supported on columns, height of vertical portion is 4m and hopper portion is 4m for storing cement having density 20kN/m^3.	20

[Turn over

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Name of the Examination: B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER - 2025

Subject : ADVANCED STRUCTURAL ANALYSIS AND DESIGN **PART-II (50 Marks)**

Use separate answer scripts for each Part

Time : Three hours Full Marks : 100

Instructions:	
I	All notations represent their standard relevant meaning.
II	If you feel that any data or condition is/are missing in any question, please assume relevant inputs and mention the same.
III	None of your answers/components of your answers should be indicative of your name/class roll no. etc.

Sl No	**Question**	**Marks**	**CO**
2	Consider a bar element of 2 nodes and relate the linear shape functions among the local and global coordinates. (8 marks) Consider a prismatic steel bar (Young's Modulus=200000N/sq-mm) of length 0.9m and cross section of 40mm x 60mm which is fixed at one end and free at another end. The bar is subjected to axial tension of 35 kN at free end. Discretise suitably, form the stiffness matrix for the system and find out axial deformation of any 3 nodes of the bar. (12 Marks)	20	CO3
3	Form the stress-streain relationship for a Plane Stress Problem. (9 Marks) Brief a real life engineering examples where an engineering element can be modelled as Axi-symmetric problem. (6 Marks)	15	CO3
4	What do you mean by structural instability problem? Express with example. (7 Marks) Briefly explain the approaches/methods that can be considered for the solution of structural instabilility problems? (8 Marks)	15	CO1