Ref. No EX/CE/T/424B/2018

B. E. CIVIL ENGINEERING 4TH YEAR SECOND SEMESTER EXAM, 2018

SUBJECT – Advanced Structural Analysis and Design

(Name in full)

Time: Three hours

Full Marks 100

(60 marks for this part)

Use a separate Answer-Script for each part

PART I

(IS 456, IS13920, IS 4998 , SP 16 are allowed in the hall)

Answer all questions

Each question carries 30 marks

(IS 875,800,1161 SP 6(1) , SP 16 and 806 are allowed in the hall)

1.Calculate by energy approach the buckling load that a column with fixed-free boundary condition can take. Apply the result to get that for a fixed-hinged column. Get the buckling load of the fixed-hinged column by finite difference method also by dividing the column into 2 and 3 parts. Compare the results.

30

2.Calculate the resultant wind shear and moment at the base section of a concrete chimney with the following details considering the simplified approach for both along and across wind effects as per IS 4998 - I :

Chimney height - 18 m

Bottom and top diameters – 2 m and 1.6 m respectively.

Wall thickness – 175 mm

Location - Kolkata

Assume M30 concrete and Fe500 steel.

Consider first two modes of vibration.

Assume reasonable values of any other data if required 30

.....*B.E.Civil Engineering 4th Year 2nd Semester*..... EXAMINATION, *2018*

SUBJECT ..... ***Advanced Structural Analysis and Design*** .....
(Name in full)

PAPER .....

Time: **Three hours**

Full Marks 100
(40 marks for this part)

Use a separate Answer-Script for each part

No. of Questions	PART II	Marks
	[Use of I.S. 456-2000 and and SP-16 are allowed in the examination hall.] **Answer [Q1 or Q2] and Q3**	
1.	a) Write short note on 'shape function' used in finite element analysis. b) Derive the shape functions for a **two-noded one dimensional element** of length 'L' in **Cartesian coordinate system**. c) Using these shape functions, derive the stiffness matrix of an one dimensional element of length 'L' if it is used in 'uniaxial problem' Assume relevant data. d) An one-dimensional bar is suspended from a support at top. It length is 'L', cross-sectional area is 'A', modulus of elasticity of the material is 'E' and density of the material is 'ρ'. Calculate the nodal displacement, strain and stress developed in it by 'finite element analysis' using ***two numbers of the above one dimensional element***, if the bar is subjected to its **self weight only**. Compare the results with its classical solution.	[3+5+5+12=25]
2.	a) Derive the shape functions for a **four-noded rectangular element** having the coordinates of the vertices as (0,0), (20,0), (20,15) and (0,15). All values are in mm. b) Using these shape functions, form the **strain-displacement matrix** for the above element having two degrees of freedom (u,v) per node in '**plane-stress condition**'. c) Using the above data, derive ***any three elements*** of the **stiffness matrix** of this rectangular element if it is used in '**plane-stress condition**'. Consider E = 2.0×10^5 N/mm^2 and ν = 0.3. Assume any other relevant data, if required.	[10+5+10=25]
3.	A **flat slab** on a series of columns with column heads has the following dimensions: i) Column spacing = 6m x 5m in X and Y directions respectively ii) thickness of main slab = 160mm iii) size of drop = 2.5m x 2m in the interior; total thickness of drop = 220mm iv) interior circular column diameter = 600mm and column head diameter = 1400mm v) exterior square column size = 600mm x 600mm with edge beam of size 600mm x 750mm vi) floor to floor height = 3.2m vii) factored dead load = 6kN/m^2 and factored live load = 4kN/m^2. Analyse an ***interior frame*** in X-direction by '**Direct design method**' and determine the design moments following the guidelines given in I.S. 456-2000.	[15]
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