Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE-NEW)/SEM-8/CE-801/3/2011

2011

ADVANCED STRUCTURAL ANALYSIS

Time Allotted : 3 Hours *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Design wind speed for consideration of wind load for a tall building in Zone *V* is 56·5 m/s. Design wind pressure is

a) 1915·35 N/m^2

b) 1596·125 N/m^2

c) 1276·9 N/m^2

d) None of these.

ii) The wind force F acting normal to the building surface depends on

a) Force coefficient

b) Effective frontal area

c) Design wind pressure

d) All of these.

iii) In force method we want to achieve ..... condition in boundaries.

a) equilibrium b) compatibility

c) consistency d) deformation.

iv) The elements stiffness matrix of a two noded bar element is

a) $\frac{AE}{L}\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ b) $\frac{AE}{L}\begin{bmatrix} -1 & 1 \\ -1 & 1 \end{bmatrix}$

c) $\frac{AE}{L}\begin{bmatrix} -1 & -1 \\ 1 & 1 \end{bmatrix}$ d) none of these.

v) $u = [N]\{d_e\}$ where $[N]$ is

a) Shape function

b) Interpolation function

c) Field variable

d) None of these.

vi) Size of the stiffness matrix for a two dimensional beam element 3 degree for freedom at each node will be

a) 6×6 b) 3×3

c) 2×2 d) None of these.

vii) As per IS 875 (Part 3) – 1987, there are ..... numbers of basic wind speed zones in India.

a) 5 b) 6

c) 4 d) 3.

viii) Seismic intensity for seismic zone 3 is

a) Low b) Moderate

c) Severe d) Very Severe.

ix) Surfaces in which the curvatures in all planes have like sings are called

a) Synclastic

b) Anticlastic

c) Synclastic or Anticlastic

d) None of these.

x) According to Novozilov, a shell may be regarded as thin if

a) $d/R \leq 1/20$

b) $d/R \leq 1/18$

c) $d/R \leq 1/10$

d) $d/R \leq 1/5$.

xi) The flextural rigidity of a plate *D* is given by

a) $Eh^3/12(1-v^2)$

b) $Eh^2/12(1+v)$

c) $Eh^4/12(1+v^2)$

d) None of these.

xii) As per IS 1893, 2002 there are ..... nos. of seismic zones in India.

a) 5 b) 3

c) 4 d) 2.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Write down the different parts of a cylindrical shell with a neat sketch.

3. Prove that in the case of a rectangular plate :

$M_x = -D\left(\partial^2 W/\partial x^2 + \upsilon\ \partial^2 W/\partial y^2\right)$ and

$M_y = -D\left(\partial^2 W/\partial y^2 + \upsilon\ \partial^2 W/\partial x^2\right)$

where the terms carry their usual meaning.

4. What do you mean by Lagrange and serendipity elements ? What is Pascal Triangle ?

5. A multi storied building having 20 m × 30 m plan dimensions & an overall height of 30 m (ground floor 5 m and other floors are 4 m in height & parapet is 1 m) is to be constructed at New town, Kolkata. Each floor units of 4 × 6 panels each of 5 m × 5 m dimension. Determine the design wind pressure active on the building & draw the pressure diagram.

6. Write short notes on any *three* of the following :

   a) Clapeyrons three moment theorem

   b) Finite element technique

   c) Statical indeterminacy and kinematic indeterminacy

   d) Theory of thin plate analysis.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Find out the value of reaction R developed at the corners of a rectangular plate size a × b when it is subjected to a sinusoidal load

$$q = q_0 \sin\left(\prod x/a\right) \cdot \sin\left(\prod y/b\right).$$

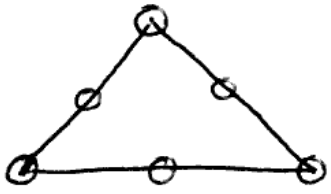
8. Derive these relationships in the case of simply supported circular cylindrical shell of radius a where the terms carry their usual meanings.

$$N_\theta = -g.a.\sin\theta$$

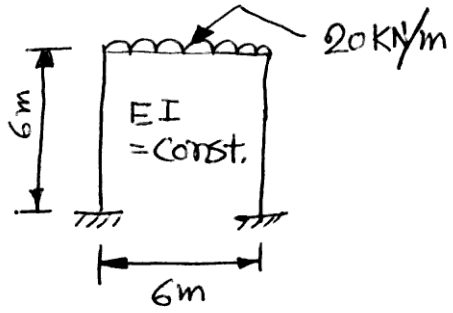
$$N_{x\theta} = -2g.x.\sin\theta$$

$$N_x = -\left(g/a\right) \cdot \left(l^2/4 - x^2\right) \cos\theta$$

9. The figure given below shows a triangular 2-D element. Find the shape function using natural co-ordinate system (Lagrangian shape function).



10. Analyse the portal frame shown in figure by stiffness matrix method.



11. Derive the fourth order differential equation of isotropic plate simply supported at four sides subjected to pure bending.