B.E. Eighth Semester (Aeronautical Engineering) (C.B.S.)

Elective - II : Finite Element Method

P. Pages : 2 **KNT/KW/16/7649**

Time : Three Hours * 0 3 4 3 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Derive stress-strain relationship for 3D states of stress. **8**

b) State and explain saint Venant's principle. **6**

OR

2. An Element of an Elastic body is subjected to a three - dimensional stress system $\sigma_x, \sigma_y, \sigma_z$. Show that if the direct strains in the directions x, y and z are ε_x, ε_y and ε_z then **14**

$\sigma_x = \lambda e + 2G\varepsilon_x$, $\sigma_y = \lambda e + 2G\varepsilon_y, \sigma_z = \lambda e + 2G\varepsilon_z$.

Where $\lambda = \dfrac{\nu E}{(1+\nu)(1-2\nu)}$ and $e = \varepsilon_x + \varepsilon_y + \varepsilon_z$

the volumetric strain.

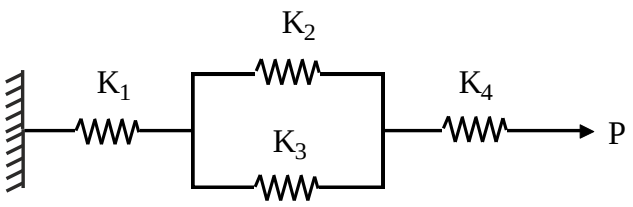
3. State and explain principle of minimum potential energy. **14**

OR

4. a) State and explain concept of virtual work. **7**

b) Define Degree of freedom. **7**
Explain 1 – D, 2 – D and 3 – D types Element their degrees of freedom.

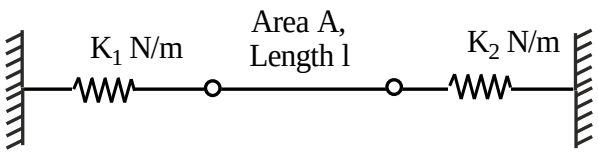
5. a) For the spring system shown below, if the stiffness of all springs is Equal to 170 kN/m and P = 250 kN, Determine. **9**
1) Global stiffness matrix. 2) Nodal displacements.
3) Reactions. 4) Force in Each spring.



b) What is the basic difference between bar and beam Elements. **4**

OR

6. a) Two springs and a bar are connected as shown. Give the stiffness matrix for the assembly if spring 1 is stretched along the axis. **8**

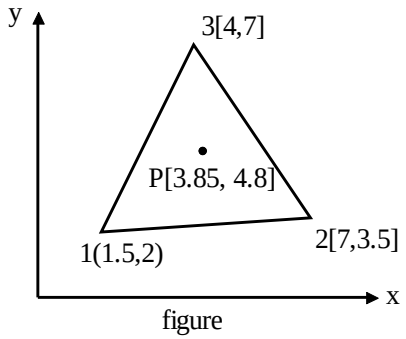


b) What are the properties of stiffness matrices? **5**

7. Derive the stiffness matrix and Equations for a CST Element. [∴ constant strain triangle]. **13**

OR

8. Evaluate the shape functions N_1, N_2 and N_3 at the interior point p for the triangular element shown in figure. **13**



figure

9. What is a Jacobian transformation? **13**
What is a Jacobian transformation for two noded isoparametric element.

OR

10. Write short note on. **13**

i) Isoparametric element sub and superparametric element.

ii) Differentiate consistent and lumped matrices.

11. Explain with suitable example three phases of FEA using a commercial FEA software. **13**

OR

12. Mention few finite Element Packages. Explain briefly their applications in various fields of Engineering. **13**

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