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10AE64

**Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018**  
**Finite Element Analysis**

Time: 3 hrs.

Max. Marks:100

*Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.*

**PART - A**

- 1 a. Explain plane stress and plane strain condition with suitable examples. (10 Marks)
- b. For the spring system shown in Fig. Q1(b). Using the principle of minimum potential energy, determine the nodal displacement. Take :  $F_1 = 75N$  and  $F_2 = 100N$ . (10 Marks)

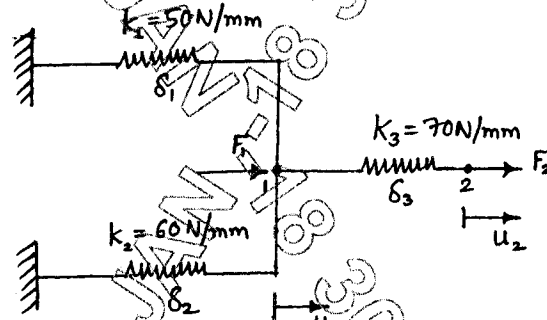


Fig. Q1(b)

- 2 a. Explain the different types of elements used in FEA with suitable examples. (10 Marks)
- b. Explain the convergence requirements and compatibility condition. (10 Marks)
- 3 a. Derive the hermit shape function for beam element and also show their variation. (10 Marks)
- b. A stepped bar shown in Fig.Q3(b). Determine the nodal displacements and the support reaction. Take  $E_1 = E_2 = 2 \times 10^5$  MPa ;  $A_1 = 100mm^2$  ;  $A_2 = 5mm^2$ . (10 Marks)

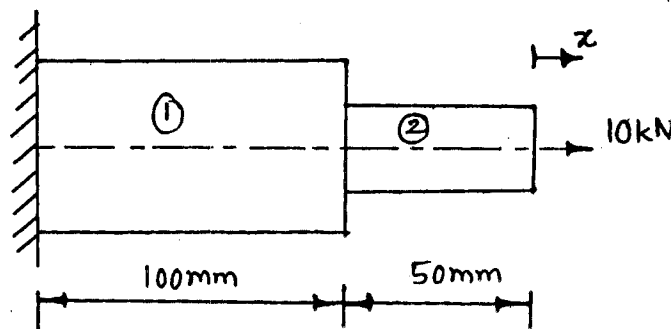


Fig.Q3(b)

Important Note : 1 On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.

- 4 a. Derive the shape function for CST element in natural coordinates and also show the variation. (10 Marks)  
 b. Sketch and explain Pascal triangle for 2 – D polynomial. (04 Marks)  
 c. Determine the Jacobian matrix and area for the triangular element shown in Fig.Q4(c). (06 Marks)

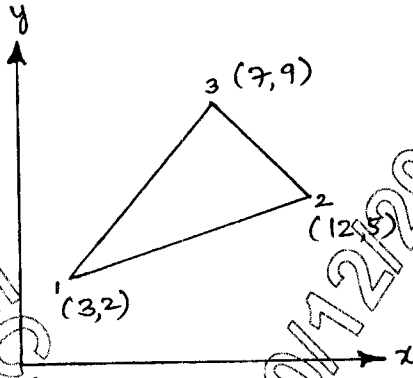


Fig.Q4(c)

**PART - B**

- 5 a. Obtain the shape functions for 8-noded hexahedral element (HEXA 8). (10 Marks)  
 b. List out the differences between serendipity and Lagrange family elements. (10 Marks)
- 6 a. Explain ISO parametric, sub parametric and super parametric elements with the help of neat sketches. (10 Marks)  
 b. List out any ten software packages used for FEA. (10 Marks)
- 7 a. Explain axisymmetric triangular element with neat sketch. (10 Marks)  
 b. Derive an expression for thermal conductivity matrix for 1-D fin. (10 Marks)
- 8 a. Solve for temperature distribution in the composite wall shown in Fig.Q8(a). Using 1 – 1 heat elements, use penalty approach of handling boundary condition. (16 Marks)

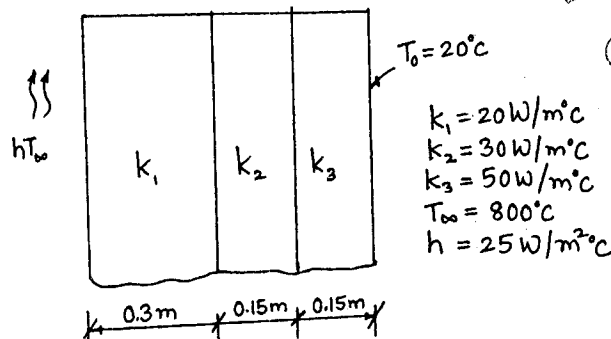


Fig.Q8(a)

- b. Write the expression for element mass matrices. (04 Marks)

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