ROLL NO:	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20 %   Max Marks: 40   Max Time: 1 hr.   Tuesday, 25th September, 2018

TEST – 1

Odd Semester 2018-19   Course: **MEC 309 Finite Element Methods**   V Sem. Mechanical

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Instruction:

(i) *Read the question properly and answer accordingly.*

(ii) *Question paper consists of 3 parts.*

(iii) Scientific and Non-programmable calculators are permitted

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Part A

(2 Q x 5 M = 10 Marks)

1. Define isotropic material and write the linear constitutive equation for a 3D isotropic material.
2. Briefly explain the steps in FEM.

Part B

(2 Q x 10 M = 20 Marks)

3. Derive the potential energy function (π) for a 3D elastic body.
4. Determine the values of X_1, X_2 & X_3 using Gauss elimination method.

$$10X_1 + 7X_2 + 5X_3 = -5$$
$$6X_1 + 4X_2 - 2X_3 = -4$$
$$5X_1 - 2X_2 + 4X_3 = 3$$

Part C

(1 Q x 10 M = 10 Marks)

5. Using the principle of minimum potential energy determine the displacement at the nodes for a spring system shown in figure1. K_1 =500 N/m, K_2=700 N/m, K_3= 400 N/m, K_4= 400 N/m, F_1 = 20 N, F_2= 10 N and F_3= 30 N.

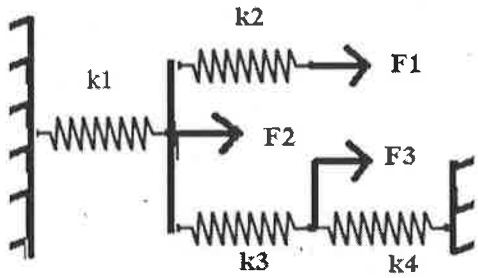

Fig. 1

ROLL NO:

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

TEST 2

Odd Semester: 2018-19
Course Code: MEC 309
Course Name: Finite Element Methods
Branch & Sem: MEC & V sem.

Date: 28 November 2018
Time: 1 Hour
Max Marks:
Weightage: 20%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.
(iv) All dimensions in mm.

Part A

Answer **all** the Questions. **Each** question carries **ten** mark. (2x10=20)

1. Derive (i) [B] matrix & (ii) [K] matrix for a 3 noded 1D bar element.

2. Determine (i) [K] (ii) [B] for the truss element shown in fig. 1

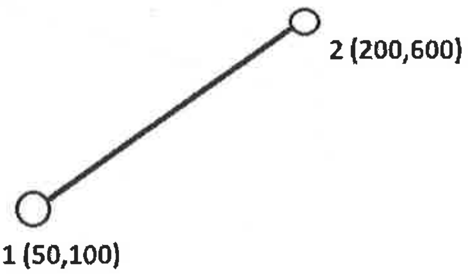

Fig .1

Part B

Answer **all** the Questions. **Each** question carries **eight** marks. (1x8=8)

3. Define a shape function. What are the properties that the shape function should satisfy?

Part C

Answer the Question. **Each** question carries **six** marks. (2x6=12)

4. Determine the shape function and temperature at point "P" for an element shown in fig. 2

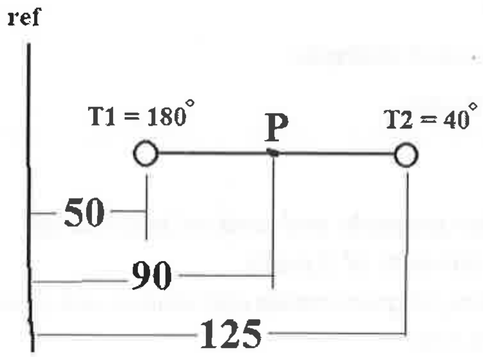

Fig.2

5. Find the shape function, Jacobian matrix & [B] matrix for a 3 noded CST element shown in fig. 3

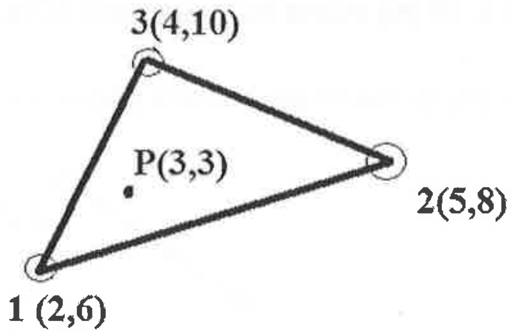

Fig. 3

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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Odd Semester: 2018-19 | **Date**: 29 December 2018

Course Code: MEC 309 | **Time**: 2 Hours

Course Name: Finite Element Methods | **Max Marks**: 80

Programme & Sem: MECH & V Sem | **Weightage**: 40%

Instructions:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted

Part A

Answer **all** the Questions. **Each** question carries **five** marks. (4Qx5M=20)

1. Derive the stiffness matrix of a 2 noded truss element.
2. Explain the concept of iso parametric, sub parametric and super parametric elements and their uses.
3. Elucidate the steps involved in FEM.
4. Explain the significance of banded matrix in FEM.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks. (3Qx10M=30)

5. Derive the Jacobian matrix of 3 noded triangular element.
6. Derive the Hermite shape functions of a beam element.
7. For a beam shown in Fig. 1 determine the deflection, slope. Given beam length 10m, I = $1 \times 10^{-6}\ m^4$ and E = 2×10^5 N/mm^2.

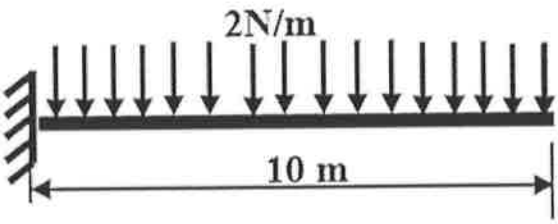

Fig.1

Part C

Answer **both** the Questions. **Each** question carries **fifteen** marks. (2Qx15M=30)

8. Consider the truss shown in Fig. 2, it is given that E=2×10^5 N/mm^2. Complete the following. Take P = 2000 N
   i. Determine the element stiffness matrix for each element.
   ii. Assemble the structural stiffness matrix K for the entire truss.
   iii. Using elimination approach, solve for the nodal displacements.
   iv. Calculate the stresses in each element.

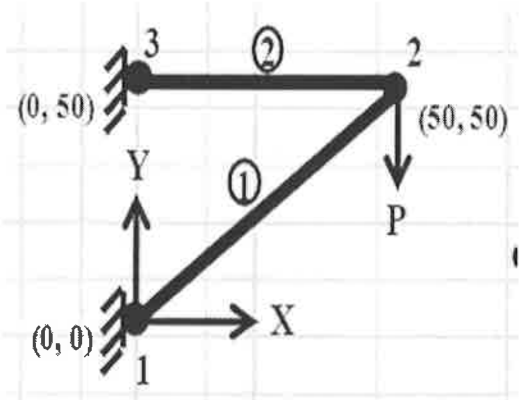

Fig.2

9. A composite wall consists of three materials as shown in Fig. 3. The outer temperature T_0 = 20 °C. Convection heat transfer takes place on the inner surface of the wall with T_∞ = 800 ° C and h=25 W/m^2 °C. Determine the temperature distribution in the wall.

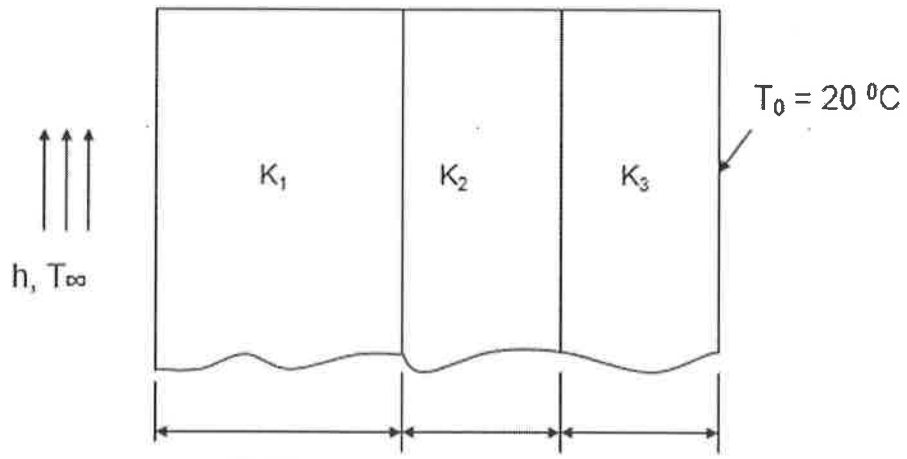

Fig.3