Name:

Enrolment No:

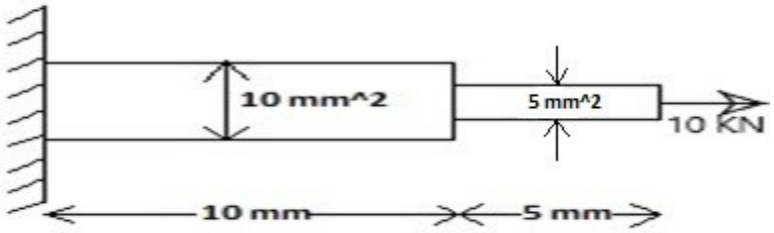
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course : Finite Element Methods
Course Code: ASEG417 **Semester : VII**
Programme : B.Tech ASE
Time : 03 hrs. **Max. Marks : 100**
Instructions : All questions are compulsory

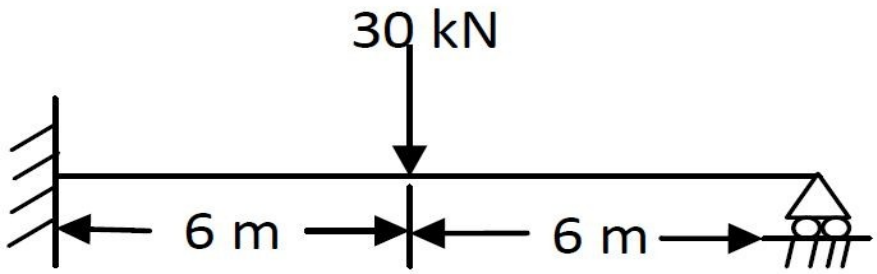
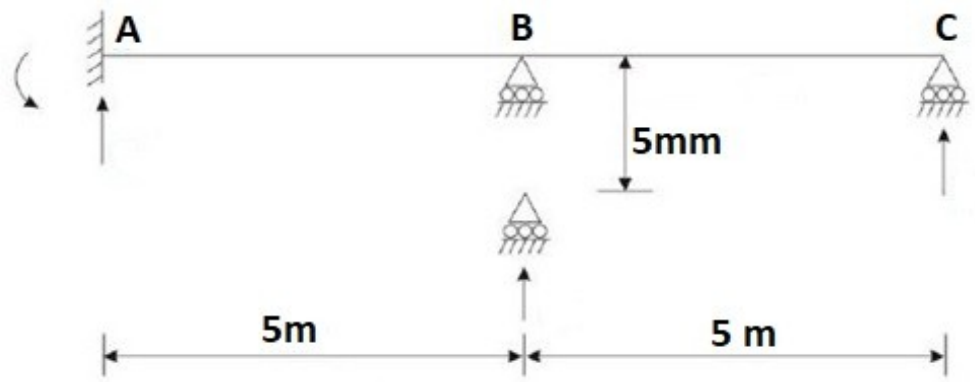
SECTION A

S. No.		Marks	CO
Q 1	Write down the advantages, disadvantages and applications of finite element method.	**4**	**CO1**
Q 2	Define shape function and stiffness matrix.	**4**	**CO1**
Q 3	Define: i. Boundary Conditions ii. Static Condensation	**4**	**CO1**
Q 4	Define isoparametric, subparametric and superparametric elements.	**4**	**CO2**
Q 5	Analyze various error source in finite element analysis softwares.	**4**	**CO5**

SECTION B

Q 6	A two element two nodded bar is shown in figure given below. Determine the nodal displacement and nodal reaction forces. The bar is made up of steel. 	**10**	**CO1**
Q 7	Illustrate the formulation of finite element method for heat conduction analysis. OR Illustrate the formulation of Plane bending analysis problem.	**10**	**CO3**
Q 8	Derive the strain displacement relationship matrix for plane stress rectangular elements	**10**	**CO3**
Q 9	Emphasis on the following methods: i. Pre-processing ii. Post-processing	**10**	**CO5**

SECTION-C

Q 10	Calculate the nodal displacement and reactions at supports for the beam shown in figure. Take E = 200 GPa and I= 24 x 10^{-6} m^4.  OR Derive the strain displacement relationship matrix for 2D isoparametric element.	**20**	**CO2**
Q 11	Using direct stiffness method, calculate support reactions in the continuous beam ABC, having constant flexural rigidity EI throughout due to vertical settlement of support B , by 5mm as shown in the figure. Assume E = 200 GPa and I = 4 X 10^{-4} m^4  	**20**	**CO4**

Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

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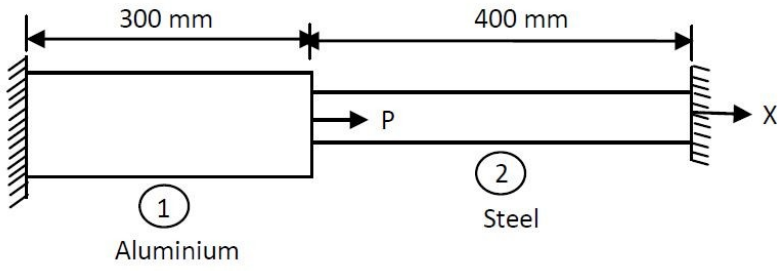
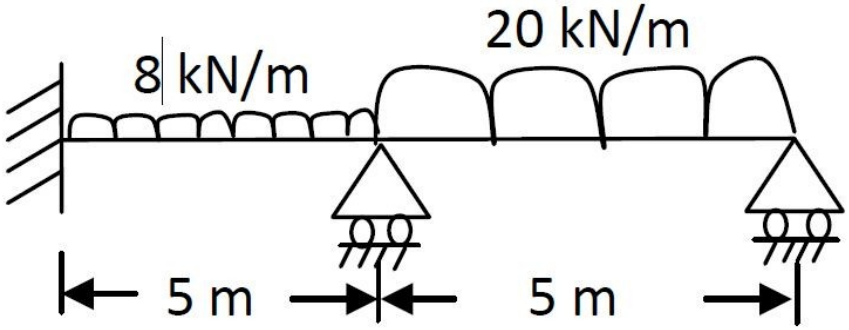
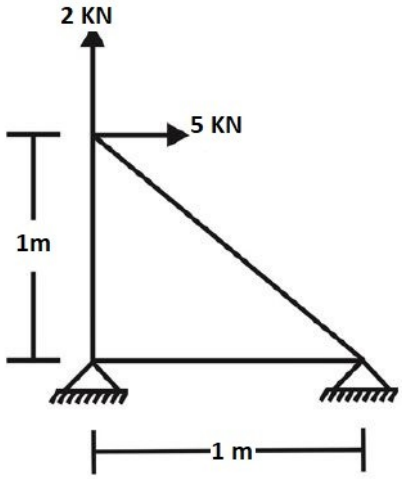
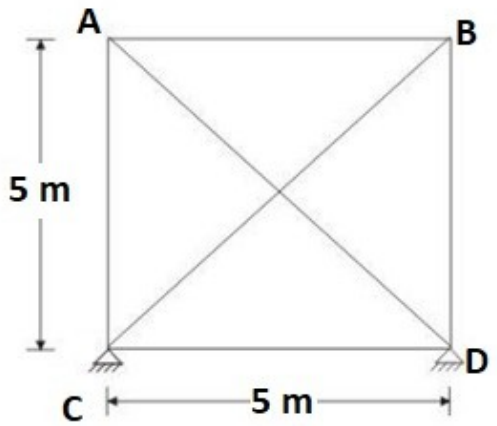
SECTION A

S. No.		Marks	CO
Q 1	Explain the concept of finite element method.	4	CO1
Q 2	Define global and local co-ordinate systems. Explain the necessity of local co-ordinate system.	4	CO1
Q 3	Define: i. Boundary Conditions ii. Static Condensation	4	CO1
Q 4	Demonstrate various degree of freedom of truss and beam structure.	4	CO2
Q 5	Analyze various error source in finite element analysis softwares.	4	CO5

SECTION B

Q 6	Determine the nodal displacements and the reaction forces for the bar shown in figure. An axial load P = 150 KN is applied as shown.  $A_1 = 2400\ mm^2$ $E_1 = 70 \times 10^9 N/m^2$ $A_2 = 600\ mm^2$ $E_2 = 200 \times 10^9 N/m^2$	10	CO1
Q 7	Illustrate the formulation of finite element method for heat conduction analysis. OR Illustrate the formulation of Plane bending analysis problem	10	CO3
Q 8	Derive the strain displacement relationship matrix for Constant Strain Triangle.	10	CO3
Q 9	Emphasis on the significance of adaptive grid.	10	CO5

SECTION-C			
Q 10	Analyze the beam shown in figure by finite element method, determine the nodal displacement, and end reactions. Given: E = 2 X 10^5 N/mm^2 and I = 5 X 10^{-19} mm^4.  OR Analyze the truss shown below by finite element method. Assume the cross sectional area of the inclined member as 1.5 times the area (*A*) of the horizontal and vertical members. Assume modulus of elasticity is constant for all the members and is *E*.  	**20**	**CO3**
Q 11	Using direct stiffness method, evaluate the member forces of truss shown in Figure below. The temperature of the member BC is raised by 40 ^{0}C and member BD is raised by 50 ^{0}C. Assume AE=300KN for all members and $\alpha = \frac{1}{75000}$ per ^{0}C.	**20**	**CO4**

	 A B 5 m C 5 m D		