CBCS Scheme

USN | | | | | | | | | |

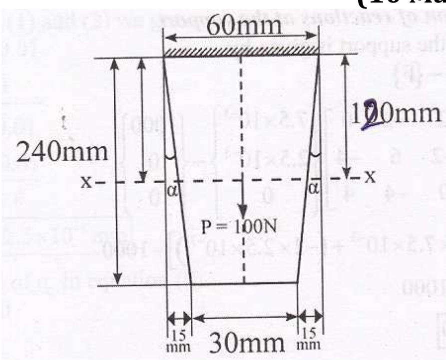
15ME6

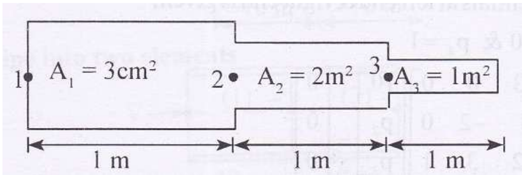
Sixth Semester B.E. Degree Examination, June/July 2018

Finite Element Method (Model QP)

Time: 3 hrs Max marks: 80

Note:Answer any FIVE full questions, choosing one full question from each module

		Module-1
1	a.	Explain briefly about node location and node numbering scheme **(06 Marks)**
	b.	Derive the equation maximum deflectionin cantilever beam of length ‘l’, Young’s Modulus ‘E’ subjected to concentrated ‘P’ at free end by Rayleigh-Ritz method. Assume algebraic displacement function.**(10 Marks)**
		OR
2	a.	Discuss the types of elements based on geometry. **(08 Marks)**
	b.	Write a note on discretisation process and convergence criterion.**(08 Marks)**
		Module-2
3	a.	Derive shape function of 2^{nd} order bar element in natural co-ordinates.**(10 Marks)**
	b.	Write the interpolation polynomial for linear, quadratic and cubic elements with neat sketches. **(06 Marks)**
		OR
4	a.	Solve for nodal displacements and elemental stresses for the tapered bar as shown in figure Q4 (a) having unit thickness, Young Modulus = 200GPa, weight density of the plate = 76.6 x 10^{-6} N/mm^3. In addition to its weight it is subjected to a point load of 100 N. Model the bar with 2 elements. **(10 Marks)**  Fig.Q.4 (a)**(10 Marks)**
	b.	Derive the stiffness matrix for truss element in terms of direction cosines. **(06 Marks)**
		Module-3
5	a	Derive the Hermite shape functions for beam element and sketch their variation in natural co-ordinates. **(16 Marks)**
		OR
6	a	Formulate stiffness matrix for the shaft subjected to torque **(08Marks)**
	b	A hollow circular section shaft 2 m long is firmly supported at both ends. It has outer diameter 8f 80 mm and inside diameter of 63.8 mm. The shaft is subjected to a torque of 12kN-m applied at a point 1.5 m from left end. Calculate the maximum shear stress and angle

		of twist in the shaft. Take shear modulus G = 8x104 N/mm2. **(08Marks)**
		Module-4
7		Calculate the temperature distribution in a composite slab consists of 3 materials with thermal conductivities of 20 W/ m-K, 30 W/m-K and 50 W/m-K. The thicknesses of each section are 0.3m, 0.15m and 0.15 m respectively. The outer surface is maintained at 100K and the inner surface is exposed to convective heat transfer co-efficient of 25 W/m^2-K and the medium at 900 K.**(16 marks)**
		OR
8	a	Derive the permeability matrix for fluid flow problems. **(08Marks)**
	b	For a smooth pipe of variable cross section shown in the fig. Q 8(b). Determine the potentials at the junctions, the velocities in each section of the pipe and the volumetric flow rate. The potential at the left end is 10 m^2/s and at the right end is 1m^2/s. Consider K_x= 1 for smooth pipe.**(08Marks)**  fig. Q 8(b)
		Module-5
9		Derive the strain displacement matrix for axisymmetric element. **(16 marks)**
		OR
10	a	Derive consistent element mass matrix for one dimensional bar element **(08Marks)**
	b	Derive consistent element mass matrix for truss element. **(08Marks)**