Hall Ticket Number:

Code No. : 21817

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

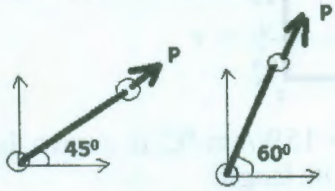
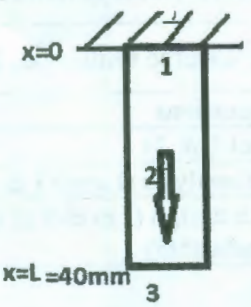
M.E. (Mech. Engg.: CBCS) I-Semester Main Examinations, January-2019

(Advanced Design & Manufacturing)

Finite Element Techniques

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Q. No	Stem of the Question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	State principle of Minimum Potential Energy.	2	1	1	1
2.	Discuss the application of the FEM for analyzing fluid flow problem.	2	2	1	2
3.	Compare the maximum value of the stresses in each case of the truss element shown below: 	2	3	2	3
4.	Explain the variation of bending stresses in a beam element formulation.	2	2	2	3
5.	Explain briefly the concept of Isoparametric approach in a Triangular 2D element.	2	2	2	3
6.	Find u, u_1, u_2, W_1 and W_2 for the following integral formulation. As per two point numerical integration. $$\int_a^b f(x)dx = \int_{-1}^{1} f(u)du = W_1 f(u_1) + W_2 f(u_2)$$	2	4	3	5
7.	Develop various boundary conditions to be imposed on a triangular plate under 2D steady state heat transfer.	2	2	3	5
8.	The Eigen values of a dynamic system are 64 and 108. Find its fundamental frequency in Hz.	2	4	3	5
9.	Calculate the stiffness matrix for a Shaft of $d = 20\ mm,\ L = 60\ mm, G = 80 \times 10^3\ N/mm^2$.	2	3	3	3
10.	In plate bending, elaborate minimum degrees of freedom to be considered at each node.	2	1	4	10
	Part-B (5 × 8 = 40 Marks)				
11.	Compute Stresses in axial bar with linear load shown below: Take E = 180 GPa, A = 100mm^2.  consider the load as 2 KN at node 2 which is a mid-node	8	3	2	3

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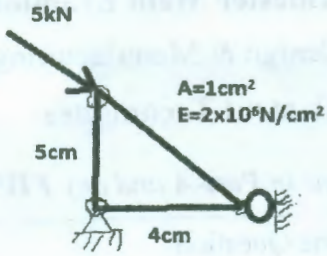
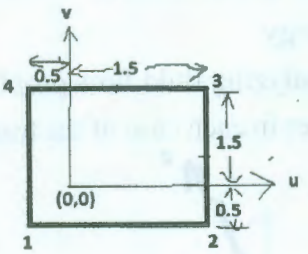
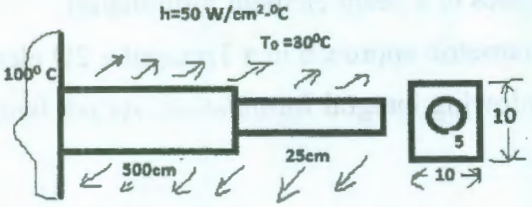
Code No.: 21817

12. Compute stresses in each link of Three member truss structure shown below: 	8	4	2	5
13. Deduce shape functions for the following quadrilateral element: Node numbers: 1, 2, 3 and 4. 	8	2	3	5
14. A metallic fin of thermal conductivity K = 15W/cm-^{0}C is shown in the figure. Compute the temperature distribution across its length. 	8	6	3	5
15. Elaborate the FEM approach to determine 3D Stresses in an elastic body.	8	1	5	10
16. a) Derive basic relations between strain and displacements.	4	2	1	1
b) Why frame element analysis is equivalent to the combination of truss element and beam element.	4	4	2	3
17. Answer any ***two*** of the following:				
a) List point wise various assumptions needed for finite element formulation of Axisymmetric models.	4	2	3	3
b) Sketch the mode shapes against three nodded axial bar having frequencies: 0, 12 rad/s and 28 rad/s and corresponding amplitude ratios: [1.2 2.6], [0.5 -1.6] and [1 -1]	4	5	4	5
c) Write basic sequence steps used in commercial ANSYS software.	4	2	5	2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	50%
2	Knowledge on application and analysis (Level-3 & 4)	35%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	15%