Reg.No. _____

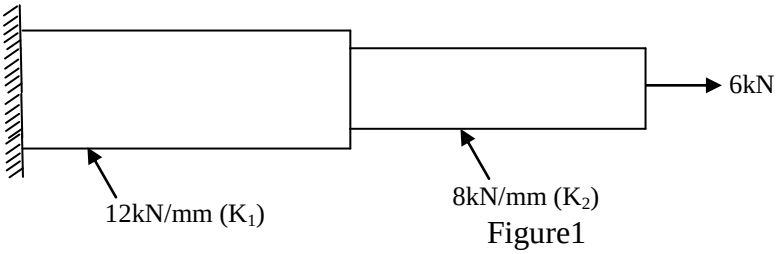
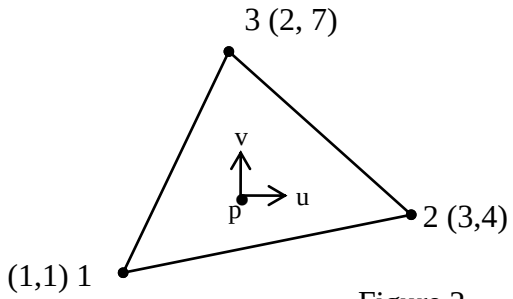
**Karunya UNIVERSITY**

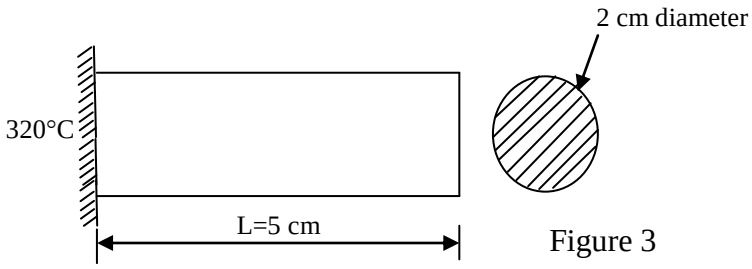
(Karunya Institute of Technology & Sciences)
(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

# End Semester Examination – Nov/Dec – 2016

**Semester : 2016-17 ODD**
**Code : 14CE3006** **Duration : 3hrs**
**Sub. Name : Finite Element Methods in Engineering** **Max. marks : 100**

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

| Q. No. | Sub Div. | Questions | Course Outcome | Marks |
|---|---|---|---|---|
| 1. | a. | Derive the stiffness matrix for 1D Truss element | CO1 | **15** |
| | b. | List the properties of stiffness matrix. | CO1 | **5** |
| | | **(OR)** | | |
| 2. | a. | With flow chart and example, explain the basic steps of FEA | CO1 | **15** |
| | b. | Write the applications of Finite element analysis in Mechanical engineering | CO1 | **5** |
| 3. | a. | Calculate the nodal displacements and nodal forces for the bar loaded as shown in the Figure1.   Figure1 | CO1 | **20** |
| | | | | |
| 4. | a. | Derive the shape functions for 1D Beam element | CO1 | **20** |
| 5. | a. | For the triangular element shown in Figure2, the nodal values of displacement are: $u_1 = 0.001$; $u_2 = 0.003$; $u_3 = -0.002$ $v_1 = -0.004$; $v_2 = 0.002$; $v_3 = 0.005$ Find the displacement u,v at point P (2, 5) within the element. (All Dimensions are in mm)   Figure 2 | CO1 | **20** |
| | | **(OR)** | | |
| 6. | a. | Derive the shape functions for 2D bilinear rectangular element (use local coordinate system) | CO1 | **20** |

| | | | | |
|---|---|---|---|---|
| 7. | a. | Consider the differential equation for the problem as, $\frac{d^2y}{dx^2}+300x^2=0$ ; $0 \le x \le 1$ with the boundary conditions y (0) = 0 and y(1) = 0. Find the solution of the problem using a one coefficient trial function as $Y=a_1X(1-X^3)$. Use (i) Point collocation method (ii) sub domain method (iii) Least square method (iv) Galerkin's method. | CO1 | **20** |
| | | **(OR)** | | |
| 8. | a. | Find the maximum deflection for a clamped beam subjected to uniformly distributed load throughout its length. Use point collocation method. Assume trial function as $y=a(x^5-2Lx^4+L^2x^3)$ | CO1 | **20** |
| | | **Compulsory:** | | |
| 9. | a. | A steel rod of diameter d=2cm, length 5cm and thermal conductivity $k=50W/m^0C$ is exposed at one end to a constant temperature of $320^oC$(shown in Figure3). The other end is in ambient air of temperature $20^oC$ with a convective coefficient of $h=100\ W/m^{20}C$. Determine the temperature at the mid point of the rod. $\phi_f = 20^\circ C,\ h = 100\frac{Watts}{m^2\ ^\circ C}\ ,\ k = 50\frac{Watts}{m\ ^\circ C}$   Figure 3 | CO1 | **20** |

ALL THE BEST