

**M. TECH.-II (MECHANICAL CAD/CAM) (CBCS – 2015  
COURSE) : WINTER - 2017  
SUBJECT: ADVANCED FINITE ELEMENT METHOD**

**Day: Monday**  
**Date: 27/11/2017**

**W-2017-2816**

**Time: 11.00 AM TO 02.00 PM**  
**Max. Marks: 60**

**N.B:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non- programmable **CALCULATOR** is allowed.
- 4) Assume suitable data if necessary.

**SECTION-I**

**Q.1** Define shape function? Derive the linear and quadratic shape function for 1D bar element? (10)

**OR**

**Q.1** Write short notes on: (10)

- a) Errors in FEM
- b) Accuracy of solution

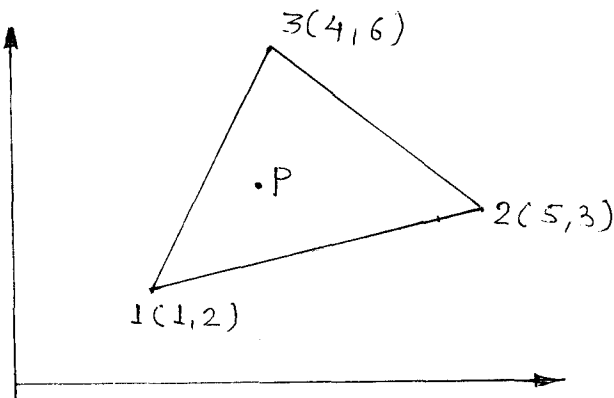
**Q.2** Derive the element stiffness matrix using potential energy approach? (10)

**OR**

**Q.2** Explain the following methods: (10)

- i) Least square method
- ii) Collocation method

**Q.3** The nodal coordinates of the triangular element are as shown in fig. At the interior point  $P_1$  the X coordinate is 3.3 and  $N_1 = 0.3$ . Determine  $N_2$ ,  $N_3$  and the Y coordinate of point P. (10)



**OR**

**Q.3** Explain the following terms: (10)

- i) Higher order element
- ii) Kirchoff's theory

**P.T.O.**

**SECTION-II**

**Q.4** Derive the element stiffness matrix for Isoparametric element? **(10)**

$$K^e = t_e \int_{-1}^1 \int_{-1}^1 B^T DB \det J d\xi d\eta$$

**OR**

**Q.4** Write short notes on: **(10)**

- a) One point formula
- b) Two point formula

**Q.5** Write the element mass matrices for: **(10)**

- i) Truss element
- ii) Quadrilateral element
- iii) Beam element

**OR**

**Q.5** State the different methods used to determine the Eigen values and Eigen vectors? Explain any two of them in details? **(10)**

**Q.6** Explain Adaptive finite element techniques used in FEM? **(10)**

**OR**

**Q.6** Give the applications of Linear buckling analysis in mechanical engineering? **(10)**

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