**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(END SEMESTER EXAMINATION)**

**CLASS: M. Tech** **SEMESTER : II**
**BRANCH: STRUCTURAL ENGINEERING** **SESSION : SP/19**

**SUBJECT: CE506 FINITE ELEMENT METHOD**

**TIME: 3 Hours** **FULL MARKS: 50**

**INSTRUCTIONS:**
**1. The question paper contains 5 questions each of 10 marks and total 50 marks.**
**2. Attempt all questions.**
**3. The missing data, if any, may be assumed suitably.**
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
**5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

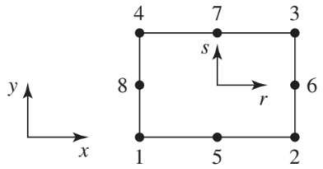
---

Q.1(a) Explain the importance of minimum potential energy principle. [5]
Q.1(b) Distinguish between direct stiffness method and finite element method of analysis of structures. [5]

Q.2(a) Explain Galerkin Finite Element Method when applied to a bar element. [5]
Q.2(b) Apply Galerkin Finite Element Method to solve the following boundary value problem using one term: [5]

$$\frac{d^2y}{dx^2} + y = 2x \quad \forall \quad 0 \le x \le 1$$
$$y(0) = y(1) = 0$$
$$y^*(x) = c_1 \cdot x(1 - x^2)$$

Q.3(a) Explain completeness requirement for shape/interpolating functions in context of FEA. [5]
Q.3(b) Write down polynomial shape/interpolating functions numbered $N_1$ *and* $N_5$ for the following element. [5]




Q.4(a) Derive stiffness matrix for CST for plane stress conditions. [5]
(Note: Do not compute matrix operations or the integrals)
Q.4(b) Explain iso-parametric formulation for quadrilateral element. [5]

Q.5(a) Explain the following steps in context of any commercial FE Application: [5]
a) Pre-Processing
b) Analysis
c) Post-processing
Q.5(b) Evaluate the following integral using 2-point Gauss quadrature: [5]

$$\int_{-1}^{1}\int_{-1}^{1}(1 + 2x + 3x^2y)dx\,dy$$

**:::::24/04/2019 M:::::**