

ROLL NO _____

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- Oct 2017

B.Tech VII / M.Tech I Semester

COURSE CODE: 13M1WCE131

MAX. MARKS: 25

COURSE NAME: Finite Element Methods

COURSE CREDITS: 3

MAX. TIME: 1.5 Hrs.

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

1. Use **Gauss quadrature** to obtain the exact values for the given integrations. Also compare with analytical results. [7 Marks]

a) $\int_0^4 x(x^2 + 1)dx$

b) $\int_{-1}^1 \cos^2(\pi\xi)d\xi$

2. Consider the following ordinary differential equation:

$$-\frac{d^2u}{dx^2} = \cos(\pi x) \quad 0 < x < 1; \quad u(0) = u(1) = 0;$$

Use the **uniform mesh of three linear elements** to solve the problem. [10 Marks]

3. The functional governing static buckling of the column as shown in **Fig # 1**, is given by

$$\pi = \frac{1}{2} \int_0^L EI \left(\frac{d^2w}{dx^2} \right)^2 - \frac{P}{2} \int_0^L \left(\frac{dw}{dx} \right)^2 + \frac{1}{2} kw_L^2$$

Where $w|_{x=L} = w_L$ and the essential boundary conditions are given as

$$w|_{x=0} = 0; \quad \frac{dw}{dx}|_{x=L} = 0$$

Derive the **Euler-Lagrangian** equation of the given functional. [8 Marks]

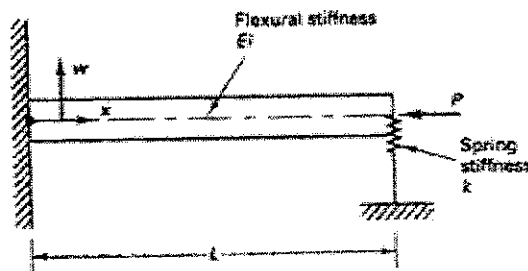


Fig # 1