M.E. First Semester (Civil (Structural Engg.)) (New - CGS)

13087 : Structural Dynamics : 1 SFSE 4

P. Pages : 2 **AU - 3447**

Time : Three Hours Max. Marks : 80

Notes :
1. All question carry equal marks.
2. Answer **two** question from Section A and **two** question from Section B.
3. Assume suitable data wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.

SECTION - A

1. a) Determine the natural frequency of the system shown in Fig.1.a. Take $E = 2\times10^5 \ N/mm^2$ The coil spring has stiffness K = 1kg/mm. **8**

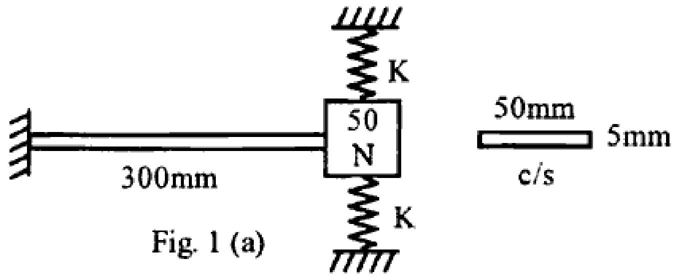


Fig. 1 (a)

b) Derive equation for response in free vibrations of an overdamped single degree freedom system. **12**

2. a) Define: **6**

i) Damping coefficient

ii) Natural frequency

iii) Damping ratio

b) Derive equation for response of a single degree freedom system with damping coefficient 'c' subjected harmonic loading $F = F_\circ \sin\bar{\omega}t$. **14**

3. Using Fourier series determine the response of a system to periodic loading shown below. **20**

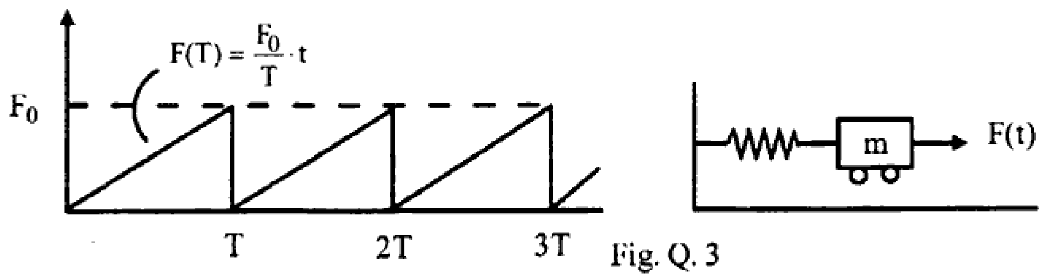
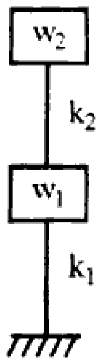


Fig. Q. 3

SECTION - B

4. Derive characteristic equation for lateral vibrations of a two degree freedom system and prove that normal modes are orthogonal. **20**

5. Compute natural frequencies and draw mode shapes in lateral vibrations for the system shown in Fig. Q. 5.



$w_1 = 100$ kN

$w_2 = 120$ kN

$k_1 - 3 \times 10^4$ kN / m

$k_2 = 2 \times 10^4$ kN / m

Fig. Q. 5

6. a) Generate the governing differential equation of motion for a simply supported beam subjected to undamped free vibrations. **10**

b) Describe the method of response spectrum design in earthquake. **10**

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