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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, M.Tech. - Mechanical Engineering (MMDN)

Semester End Examination; May / June - 2019

Advanced Theory of Vibrations

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Any missing data may be assumed suitably.

UNIT - I

1. A single degree of freedom spring-mass-damper system is subjected to periodic excitation shown in Fig. Q.1. Obtain the expression for response of the system. Assume the natural frequency of the system as 0.5 rad/s and damping factor of 0.1. Also take stiffness of the system as $\frac{400}{15\pi}$ N/mm , $F_0 = 10$ N. 20

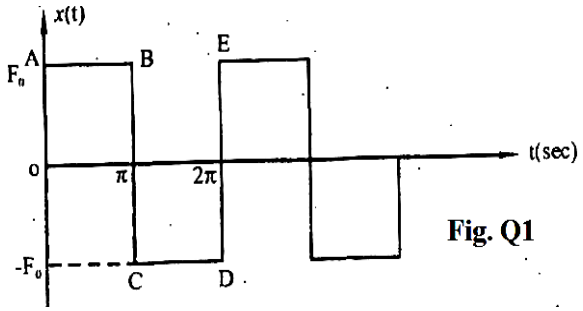

Fig. Q1

2. An undamped single degree of freedom system is subjected to a non-periodic force as shown in Fig.Q.2. Obtain the response of the system, when $t < t_0$ and $t > t_0$, by method of convolution integral. 20

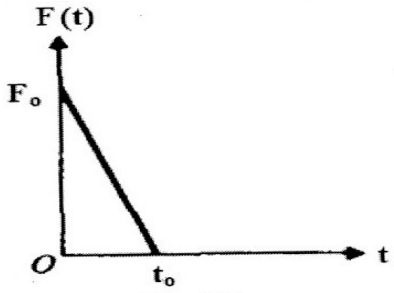

Fig.Q2

UNIT - II

3 a. Explain;

i) Generalized coordinates

ii) Coordinate coupling 8

iii) Static coupling

iv) Dynamic coupling

Contd…2

b. Obtain stiffness coefficients for the system show in Fig.Q.3(b) 12

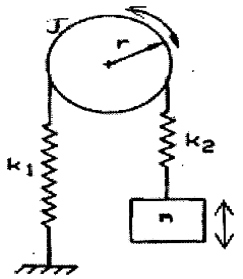

Fig.Q3(b)

4. Obtain the amplitudes of steady state vibration of the system shown in Fig Q.4. 20

Take $f(t) = 250 \sin 40t$.

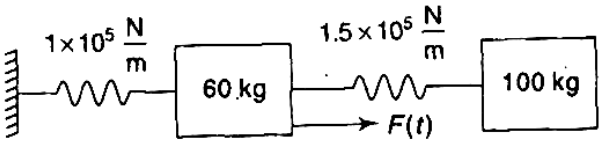

Fig.Q4

UNIT - III

5. A uniform string with initial tension '*s*' is displaced as shown in Fig Q.5 and released at time $t = 0$. Find the equation of motion for the string. 20

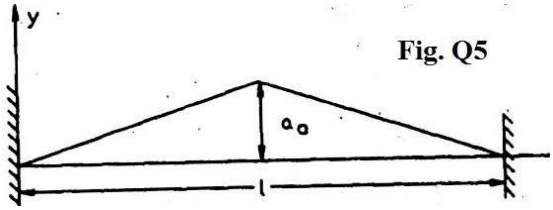

Fig. Q5

6. Obtain the frequency equation for lateral vibrations of a cantilever of uniform section having length *l*. 20

UNIT - IV

7. With the help of necessary figures, equations and graphs, explain the working principle of Vibrometer, accelerometer and velocity pick-up. 20

8 a. Sketch and explain; 20

i) Non contacting type Vibrometer

ii) Piezoelectric type accelerometer

iii) Electro dynamic shakes

UNIT - V

9 a. Using a point mass attached to the midpoint of a stretched string, explain hardening spring non-linearity. 12

b. With the help of a simple pendulum, explain softening spring non-linearity. 8

10 a. Explain phase-plane trajectories for a linear system. 8

b. Using method of isolines construct phase-plane trajectories for a linear damped system, where damping factor is 0.5 and natural frequency is 1 rad/s. 12

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