U.S.N | | | | | | | | | |

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

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; Jan. - 2020

Structural Dynamics – Theory and Computations

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Obtain the differential equation of motion for undamped free vibration of SDOF system. 10

b. Calculate the natural frequency in the horizontal direction for the frame shown in Fig. Q1(b). Also obtain the response equation and find the displacement at time $t = 1$ second, if the initial displacement is 2.5 mm and initial velocity is 50 mm/s.
Assume EI of column to be 2.5×10^{13} N–mm^2. 10

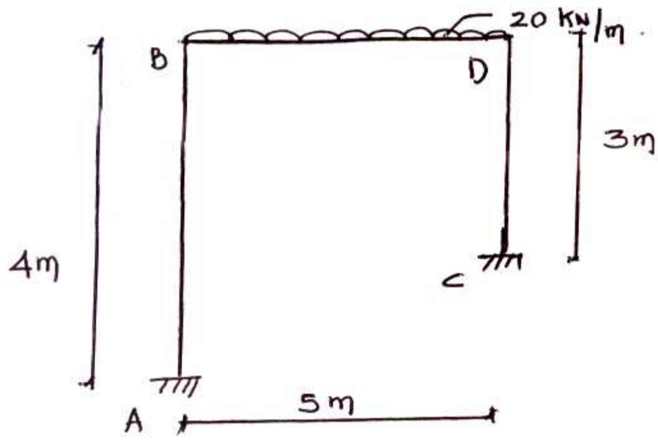

Fig. Q1(b).

2 a. What is the damping? Explain any one method of evaluating damping using free vibration test. 10

b. The mass of 20 kg is resting on a spring stiffness of 15 N/mm and damper of damping coefficient 0.15 N-s/mm. If the initial velocity is 200 mm/s at rest position, find the displacement at 1 second. 10

UNIT - II

3 a. A spring mass dashpot system is subjected to harmonic force $F_0.\sin\bar{\omega}t$. Obtain the expression for magnification factor for no damping case. 10

b. An engine at 500 kg mass is mounted on spring with stiffness 200 kN/m and damping ratio 0.2. The machine has an unbalance mass of 10 kg and an eccentricity of 100 mm. Find the dynamic amplitude transmissibility ratio and force transmitted to the foundation if the engine operates at 200 rpm. 10

4 a. Obtain the expression for Duhamel's integral for the response due to general dynamic loading. 8

b. What is transmissibility ratio? Obtain the expression for transmissibility of SDOF system when base is subjected to motion $Y_s = Y_0 \sin\bar{\omega}t$. 12

UNIT - III

5. For the two storey shear building shown in Fig. Q5, formulate the equation of motion and find the natural frequencies and mode shapes of vibration. Assume $E_c = 25000$ N/mm^2. 20

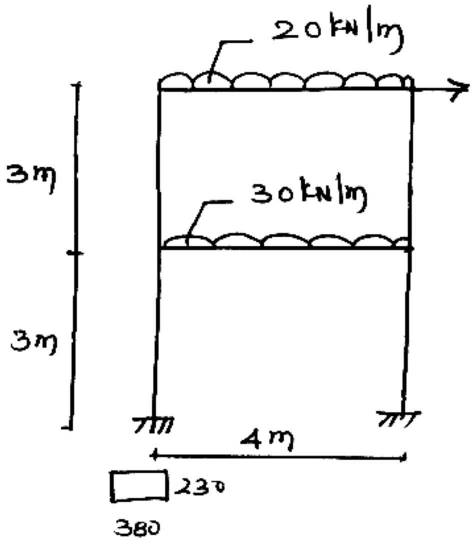

Fig. Q5.

6. Determine the natural frequencies and mode shapes for the three–DOF spring mass system shown in Fig. Q.6. 20

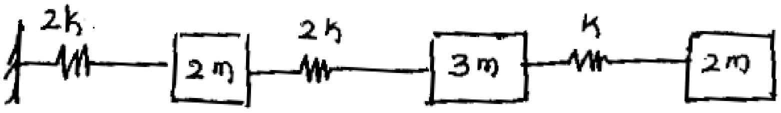

Fig. Q.6.

UNIT - IV

7 a. Obtain the expression for vibration of uniform beam and the solution for equation of motion in free vibration. 10

b. Obtain the expression for natural frequency of simply supported beam treating the beam as continuous system and plot the first three modes. 10

8. Obtain the expression for equation at motion of members under longitudinal vibration and obtain the natural frequency of member having one end fixed and the other end free. 20

UNIT - V

9. Using the cubic Hermitian polynomials, determine the stiffness coefficient K_{ii} for i = 1 to 4 for two noded Euler–Bernoulli element. 20

10. Determine the natural frequency for fixed beam shown in Fig. Q10 20

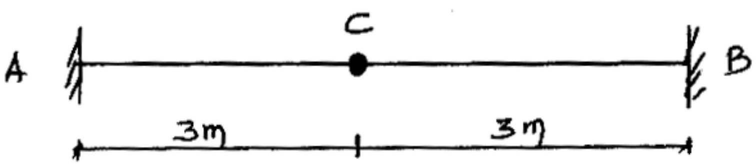

Fig. Q10

* * *