Registration no: | | | | | | | | | | |

Total Number of Pages: 2 **M.TECH**
CEPC 102

1stSemester Regular/BackExamination – 2015-16
STRUCTURAL DYNAMICS
BRANCH(S):STRUCTURAL ENGG.
Time: 3 Hours
Max marks: 70
Q.CODE-T1108

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 State briefly the following (2 x 10)

a) Harmonic and periodic motion
b) Transient vibration
c) Under damped system
d) Response spectra
e) Eigen values and Eigen vectors
f) Root mean square value
g) Flexibility influence coefficients
h) Specific damping capacity
i) Hysteresis loop
j) Random time function

Q2 a) A spring mass system has a natural frequency f_1. Calculate the value of k_2 of another spring which when connected to k_1 in parallel increase the frequency by 40%. (5)

b) For a damped system, m, c and k are known to be m = 2 kg, c = 3 kg/s and k = 20 N/m. Calculate the value of damping ratio and natural frequency. Is the system under-damped, over-damped or criticallydamped? (5)

Q3 Determine the time response of the undamped spring mass system to the linearly increasing pulse force. (10)

Q4 a) A body of mass 10 kg is hung on two helical springs in parallel. One spring is elongated 2 cm by a force of 5 N and the other requires a force of 6 N for elongation of 2 cm. Calculate the natural frequency of vibration. (5)

b) The following data are given for a vibrating system with viscous damping: m = 5 kg, k = 5000 N/m, c = 20 N-s/m. Determine the logarithmic decrement and the ratio of any two successive amplitudes. (5)

Q5 a) A mass weighing 100N is supported by a spring of stiffness 20 kN/m. and a viscous damper. During free vibrations, the amplitude of vibration decreases to one tenth of its initial value in the complete oscillations. Find the value of damping coefficient of the damper. (5)

b) A reciprocating pump of 150 kg mass is driven through a belt by an electric motor at 3000 rpm. The pump is mounted on isolators with total stiffness 4.5 MN/m and damping of 3 kN-sec/m. Calculate the vibratory amplitude of the pump running speed due to fundamental harmonic force of 1.25 kN. (5)

Q6 a) What do you mean by continuous models in vibrations? (3)

b) Derive Euler equation for transverse vibration of beams. (7)

Q7 a) Find the natural frequency of a fixed beam 10 m long carrying 10 kN load at the center. Neglect mass of the beam. (3)

b) The differential equations governing the motion of a two degree of freedom system are (7)

$$\begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix} \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix} + \begin{bmatrix} k & -k \\ -k & 2k \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$$

. Determine the system's natural frequencies.

Q8 Write Short Notes (Any Two) (5 x 2)

a) Band width method

b) Decoupling of forced vibration equations

c) Orthonormal modes

d) Vibration Damper