BE/ B.TECH(Full TIME) **DEGREE END SEMESTER EXAMINATIONS, APR/MAY 2013**

FIFTH SEMESTER MECHANICAL ENGINEERING (R-2008)

ME 9024 MECHANICAL VIBRATION AND NOISE - (Elective)

TIME : 3 Hr Max . Mark : 100

PART –A (10 X 2 = 20 MARK)

Answer all questions

1. Distinguish steady state and random vibration with one example for each case.
2. Define rigid and flexible rotors.
3. What is meant by static coupling in the formulation of equation of motion in a two degree freedom vibration?
4. What are the main limitations of undamped dynamic vibration absorber?
5. Define normal mode vibration of multi degree freedom system.
6. What is meant by orthogonality property of modal vectors ?
7. What is the role of filters in vibration measuring system?
8. Differentiate time domain and frequency domain vibration signal with an example.
9. What are the three types of acoustic field?
10. Define sound transmission coefficient of a wall.

PART – B (5 X 16 MARK= 80 MARK)

11. A 100 kg machine is placed at the mid span of simply supported beam of length 3 m , $E = 200 \times 10^9$ N / m^2 and M.I = 1.3×10^{-6} m^4 .During the operation of the machine, it is subjected to a harmonic excitation of magnitude 5000 N at speeds between 600 rpm and 700 rpm . Calculate the stiffness and mass of the suitable un damped vibration absorber such that machine's steady state amplitude is less than 3 mm at all operating conditions.

12(a) A small high speed turbine has single wheel of mass 6 kg mounted at the mid point of a 10 mm diameter steel shaft. The span of the short support bearings is 450 mm. Owing to slight manufacturing defect, the c.g of the wheel is 0.025 mm away from centre of rotation. E of the shaft material is 200 GN / m^2 If the turbine rotates at 3000 rpm , determine

i. Critical speed of rotation
ii. amplitude of steady state vibration of the shaft,

OR

12 (b) i. Explain different types of damping encountered by the vibrating systems (6 mark)

ii. Explain the free response behavior of single degree freedom vibration under the following conditions:

1. over damped 2. Critically damped 3. Under damped (10 mark)

13(a) The differential equations of a two degree freedom system are

$$\begin{bmatrix} m & 0 \\ 0 & m \end{bmatrix} \begin{bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{bmatrix} + \begin{bmatrix} 2k & -k \\ -k & 3k \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{matrix} 0 \\ 0 \end{matrix}$$

Determine the natural frequencies

OR

13(b) . i. Prove the orthogonal character of eigen vectors (8 mark)

ii. Obtain the flexibility influence coefficient matrix for a simply supported beam of flexural strength EI and span L subjected to two point loads , one at mid span. and other at ¼ th span from left support. (8 mark)

14 (a) A displacement type vibration measuring instrument is mounted on a machine running at 1000 rpm. The natural frequency of the instrument is 20 rad /s . The instrument records a relative amplitude of 0.5 mm, Calculate the displacement , velocity and acceleration of the of the machine. Damping in the instrument is neglected

OR

14(b) . .i. Explain the working principle of electro dynamic exciters. (8 mark)

ii. Briefly explain the features of the following :

1. Seismometer 2. FFT Analyzers. (8 mark)

15(a) i. Explain with a block diagram the principle of working of a sound level meter. (8 mark)

ii Calculate the sound pressure level associated with the following r.m.s sound pressure:

1. 0.106 Pa 2. 20 Pa (8 mark)

OR

15(b) Describe the following with suitable examples:

i. Discrete frequency noise

ii. Broad band noise

iii. Impulsive noise.

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