CBCS SCHEME

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18CAE/MDE12

First Semester M.Tech. Degree Examination, July/August 2021
Advanced Theory of Vibration

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Derive general solution for damped free vibration of a single dof system of mass 'm' spring constant 'K' and obtain complete solution for the displacement x(t) for undamped condition. **(10 Marks)**

b. A vibrating system has the following parameters m = 6kg, k = 200N/m c = 6Ns/m. Determine:
   i) the damping factor
   ii) the natural frequency of damped vibration
   iii) logarithmic decrement
   iv) the ratio of two consecutive amplitude
   v) the number of cycle after which the original amplitude is reduced to 40%. **(10 Marks)**

2 a. What is dynamic vibration absorber and vibration isolation? Derive the expression for the transmissibility ratio. **(10 Marks)**

b. An engine weighing 1,000N including reciprocatory parts is mounted on springs. The weights of the reciprocating parts is 22N and the stroke is 90mm. The engine speed is 720rpm. i) Neglecting damping. Find the stiffness of the springs, so that the force transmitted to the foundation is 5% of the amplitude force (F_o) ii) If under the actual working condition the damping. **(10 Marks)**

3 a. Classify the vibration transducers. What are the difference between a transducer and pickup? **(04 Marks)**

b. With a neat sketch, explain Fram's reed to tachometer. **(06 Marks)**

c. Explain the principle of 'seismic' instrument. A seismic instrument has natural frequency of 6Hz. What is the lowest frequency beyond which the amplitude can be measured within 2% error Neglect damping? **(10 Marks)**

4 a. Explain the following machine vibration monitoring technique
   i) Time domain analysis
   ii) Frequency domain analysis. **(10 Marks)**

b. Define the term Kurtosis and Cepstrum **(02 Marks)**

c. Explain three types of maintenance schemes used in practice for machinery. **(08 Marks)**

5 a. With a neat sketch, explain the following :
   i) Convolution integral
   ii) Pulse Excitation
   iii) Impulse excitation. **(12 Marks)**

b. Obtain the response for a spring mass system subjected to the excitation shown in Fig Q5(b)

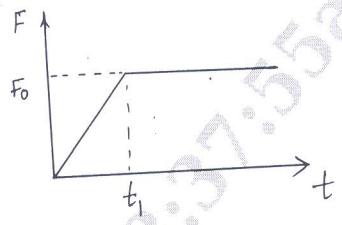

Fig Q5(b) **(08 Marks)**

6 a. Explain the following terms :
   i) Ergodic process
   ii) Expected value
   iii) Power spectral density function
   iv) Auto correlation **(12 Marks)**

b. A random signal has a spectral density that is constant. $s(f) = 0.004cm^2/cps$ between 20 and 1200cps and that is zero outside the frequency range. Its mean value is 2.0cm. Determine its rms value and its standard deviation. **(08 Marks)**

7 a. Explain the difference between linear and nonlinear vibration. **(06 Marks)**

b. Explain briefly the Jump phenomenon with respect to non-linear vibration. **(06 Marks)**

c. A mass of 'm' is attached to a stretched wire with the initial tension 'T' as shown in Fig Q7(c). Show that the governing equation of motion is non-linear where 'ℓ' is the length of the wire.

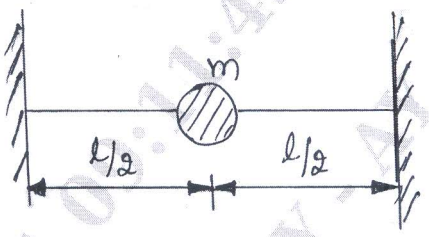

Fig Q7(c) **(08 Marks)**

8 a. Explain in detail about perturbation method. **(10 Marks)**

b. Explain the stability of equilibrium for a non – linear system. **(10 Marks)**

9 a. Obtain an expression for general solution of a string. The tension 'T' is large and amplitude of vibration is small. **(10 Marks)**

b. Determine the natural frequencies and the free vibration solution of a bar fixed at one end and free at the other end. **(10 Marks)**

10 a. Determine the normal functions in transverse vibration for a simply supported beam of length 'ℓ' an uniform cross section. **(10 Marks)**

b. Derive the general solution for the torsional vibration of a circular shaft. **(10 Marks)**

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