CBCS SCHEME

USN | | | | | | | | | |

18CAE/MDE12

First Semester M.Tech. Degree Examination, Jan./Feb.2021
Advanced Theory of Vibrations

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Derive an expression for natural frequency of spring mass system considering the effect of mass of the spring. **(10 Marks)**

b. A vibrating system is defined by following parameters m = 6 kg, K = 200 N/m, C = 3 NS/m. Determine (i) Critical damping coefficient (ii) The damping factor (iii) The natural frequency of damped vibration (iv) Logarithmic decrement (v) The ratio of two consecutive amplitudes and (vi) The number of cycles after which the original amplitude is reduced to 20%. **(10 Marks)**

OR

2 a. Explain (i) Vibration isolation (ii) Dynamic vibration absorber. **(10 Marks)**

b. Derive an expression for transmissibility ratio. **(10 Marks)**

Module-2

3 a. Explain (i) Transducers (ii) Vibration pickups (iii) Vibration exciters (iv) Signal analysis. **(10 Marks)**

b. What are the basic components of vibration measurement systems? **(10 Marks)**

OR

4 a. Explain different types of maintenance strategies vibration systems. **(10 Marks)**

b. Explain time domain and frequency domain analysis of vibration monitoring techniques. **(10 Marks)**

Module-3

5 a. Find the Laplace transform of step functions: (i) Au(t), (ii) Au(t-a). These functions are as shown in Fig. Q5 (a) – (i) and Fig. Q5 (a) – (ii). **(10 Marks)**

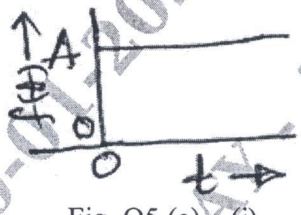


Fig. Q5 (a) – (i)

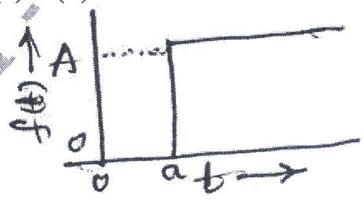


Fig. Q5 (a) – (ii)

b. Find the Laplace transform of a pulse of height A and duration τ as shown in Fig. Q5 (b). Deduce the Laplace transform of unit impulse. **(10 Marks)**

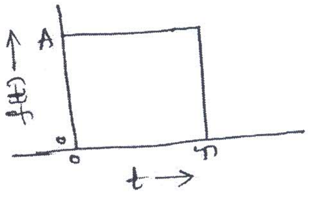
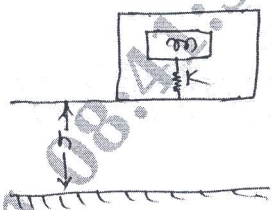


Fig. Q5 (b)

OR

6 a. A container having an apparatus suitably packed inside it is schematically represented in Fig. Q6 (a). When the package is dropped on a hard surface during loading or unloading, analyse the system for its response. **(10 Marks)**



Package dropping on a hard surface
Fig. Q6 (a)

b. A trailer being pulled at high speed, hits a 'h' cm high curb. Considering the trailer to be a single degree freedom spring-mass system as shown in Fig. Q6 (b). Analyse the system for its response. **(10 Marks)**

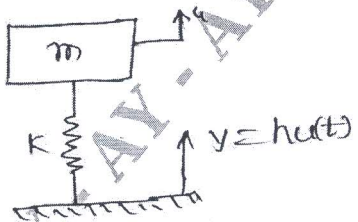


Fig. Q6 (b)

Module-4

7 a. Determine the phase plane of single degree of freedom oscillator : $\ddot{x} + W^2 x = 0$. **(10 Marks)**

b. Explain the conservative system and show that for a conservative system, the force is equal to the negative gradient of the potential energy? **(10 Marks)**

OR

8 a. Determine the oscilines for the simple pendulum. **(10 Marks)**

b. What is self excited oscillations? Explain. **(10 Marks)**

Module-5

9 a. Derive differential equation of motion for the longitudinal vibration of uniform bar. **(10 Marks)**

b. Determine the normal functions for free longitudinal vibration of a bar of length 'l' and uniform cross section. One end of bar is fixed and other is free. **(10 Marks)**

OR

10 a. Derive the frequency equation of torsional oscillation for a free shaft of length 'l'. **(10 Marks)**

b. Derive the ID wave equation for lateral vibrations of string. **(10 Marks)**

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