CBCS SCHEME

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15AU82

Eighth Semester B.E. Degree Examination, Aug./Sept.2020
Mechanical Vibrations

Time: 3 hrs. Max. Marks: 80

Note: i) For Regular Students: Answer any FIVE full questions irrespective of modules.
ii) For Arrear Students : Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. A harmonic has an amplitude of 0.05 m and a frequency 25 Hz. Find the time period, maximum velocity and maximum acceleration. **(06 Marks)**

b. With a neat sketch, explain beat phenomenon. **(06 Marks)**

c. Explain the following:
(i) Linear and non-linear vibration
(ii) Transverse and torsional vibration **(04 Marks)**

2 a. Determine the natural frequency of a spring mass system where the mass of the spring is also to be taken into account. **(08 Marks)**

b. Determine the natural frequency of the system shown in Fig.Q2(b).

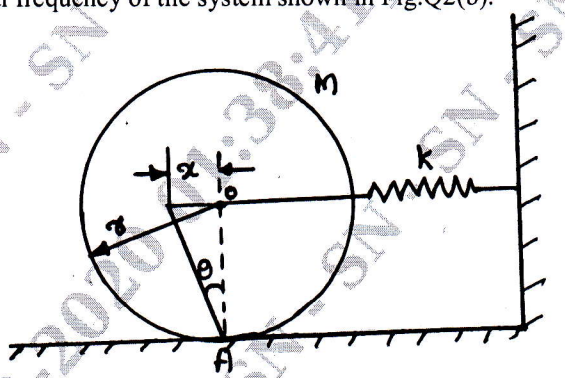

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. List and explain different types of damping. **(08 Marks)**

b. Derive the expression for the logarithmic decrement 'δ'. **(08 Marks)**

4 a. What is critical speed of shaft? Discuss speeds above and below critical speed with and without air damping. **(08 Marks)**

b. A shaft carrying a rotor of weight 450 N and eccentricity 2.54 mm rotates at 1200 rpm. Determine:
(i) Steady state whirl amplitude
(ii) Maximum whirl amplitude during start up condition of the system.
Assume the stiffness of shaft as 36000 N/m and external damping ratio as 0.1. **(08 Marks)**

Module-3

5 a. A mass of 100 kg has been mounted on a spring dashpot system having spring stiffness of 19,600 N/m and damping coefficient of 100 N-sec/m, the mass is acted upon by a harmonic force 39 N at the undamped natural frequency of the system. Determine:
(i) Amplitude of vibration of the mass
(ii) Phase difference between the force and displacement
(iii) Force transmissibility ratio **(08 Marks)**

b. Write notes on:
(i) Vibration Isolation
(ii) Transmissibility **(08 Marks)**

6 a. An engine weighing 1000 N including reciprocatory part is mounted on springs. The weights of reciprocating part is 22 N and the stroke is 90 mm. The engine speed is 720 rpm.
(i) Neglecting damping find the stiffness of the spring, so that the force transmitted to the foundation is 5% of the amplitude force
(ii) If under the actual working condition the damping reduces the amplitude of successive vibration by 25%, determine force transmitted at 720 rpm. **(08 Marks)**

b. A machine of mass one tone is acted upon by external force of 2450 N at a frequency of 1500 rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2 mm under the machine load and an estimated damping factor of 0.2 are used. Determine:
(i) Force transmitted to the foundation
(ii) Amplitude of vibration of the machine
(iii) Phase lag of the transmitted force with respect to external force. **(08 Marks)**

Module-4

7 Use Lagrange's equation to find equations of motion for a system shown in Fig.Q7(i) and (ii).

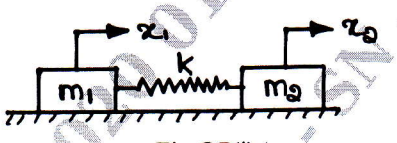

Fig.Q7(i)

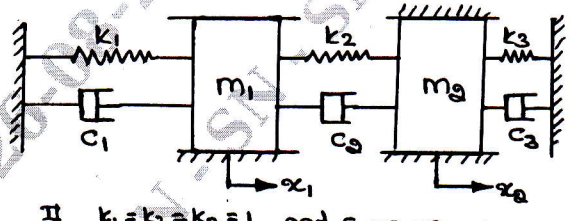

Fig.Q7(ii) **(16 Marks)**

8 With sketch, explain the following:
(i) Vibrometer
(ii) Accelerometer
(iii) Fullarton tachometer **(16 Marks)**

Module-5

9 Determine the natural frequencies and mode shape of the system shown in Fig.Q9.

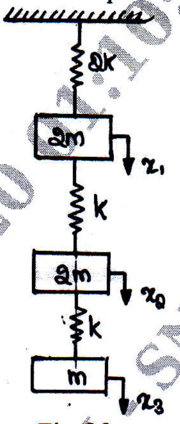

Fig.Q9 **(16 Marks)**

10 a. Derive the expression for natural frequency by Dunkerley's method. **(08 Marks)**

b. Find the lowest natural frequency of transverse vibration for the system shown in Fig.Q10(b) by Rayleigh's method.

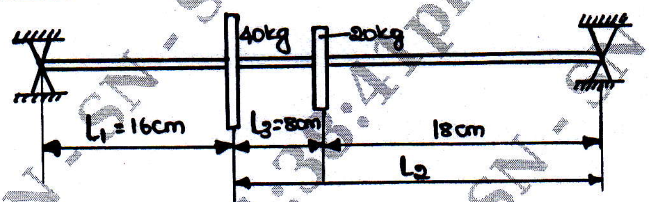

Fig.Q10(b) **(08 Marks)**

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