



# CBCS SCHEME

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 (04 Marks)  
(ii) Transverse and torsional vibration
- 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).

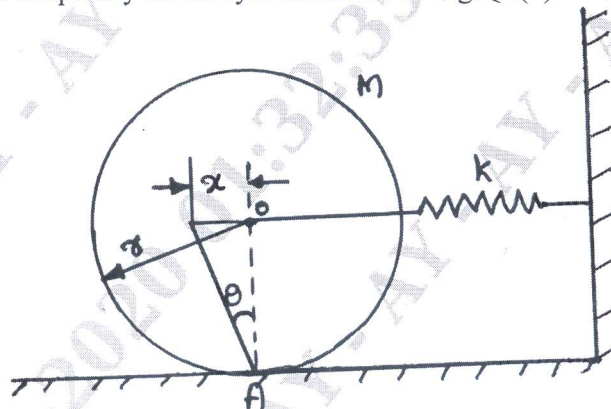


Fig.Q2(b)

(08 Marks)

### Module-2

- 3 a. List and explain different types of damping. (08 Marks)  
b. Derive the expression for the logarithmic decrement ' $\delta$ '. (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:
- Amplitude of vibration of the mass
  - Phase difference between the force and displacement
  - Force transmissibility ratio
- (08 Marks)
- b. Write notes on:
- Vibration Isolation
  - 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.
- Neglecting damping find the stiffness of the spring, so that the force transmitted to the foundation is 5% of the amplitude force
  - 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:
- Force transmitted to the foundation
  - Amplitude of vibration of the machine
  - 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).

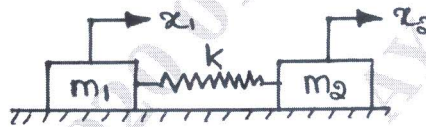
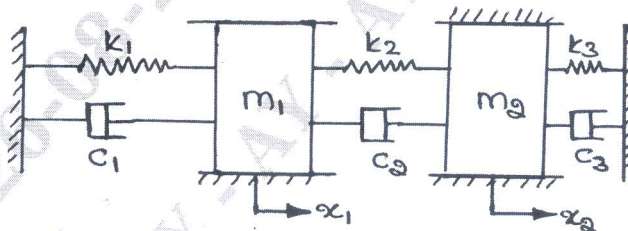


Fig.Q7(i)



If  $k_1 = k_2 = k_3 = 1$  and  $c_1 = c_2 = c_3 = 1$   
and  $m_1 = m_2 = 1$

Fig.Q7(ii)

(16 Marks)

- 8 With sketch, explain the following:

- Vibrometer
- Accelerometer
- Fullarton tachometer

(16 Marks)

**Module-5**

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

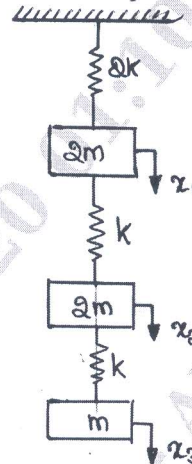


Fig.Q9

(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.

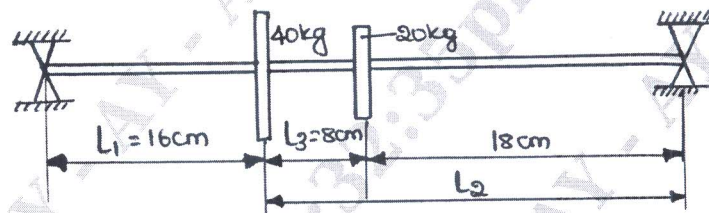


Fig.Q10(b)

(08 Marks)

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