Roll No. | | | | | | | | | | | | |

Total No. of Questions : 09

Total No. of Pages : 03

B.Tech. (ME) (Sem.–7,8)

MECHANICAL VIBRATIONS

Subject Code : BTME-803

M.Code : 71996

Date of Examination : 23-12-22

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Answer briefly :

a. What is harmonic motion?

b. What is the difference between undamped free vibration and damped free vibration.

c. What are the three elementary parts of vibrating system.

d. What is torsional vibration absorber?

e. What is principal co-ordinate?

f. What do you know about Euler's equation of motion for beam vibration?

g. Differentiate between vibration absorber and vibration isolator.

h. What is the importance of critically damping system?

i. What is lateral vibration of a string?

j. What is orthogonality principle?

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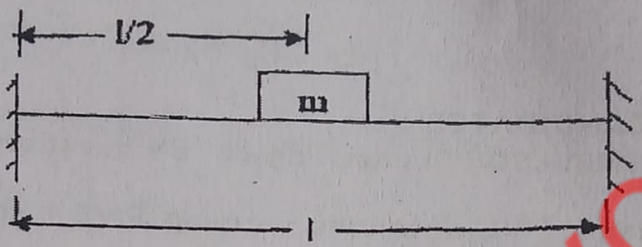
SECTION-B

2. A harmonic motion is given by $x(t) = 10 \sin\left(30t - \frac{\pi}{3}\right)$ mm where t is in seconds and phase angle in radians. Find (i) frequency and period of motion (ii) the maximum displacement, velocity and acceleration.

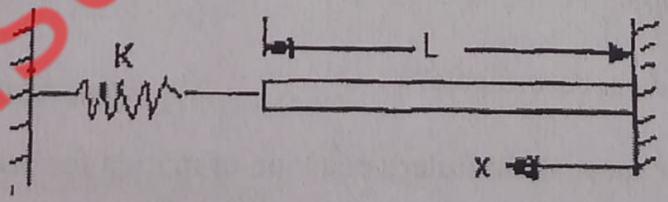
3. Find the natural frequency of the system shown in fig.



4. A reciprocating engine has a mass of 40 kg and runs at a constant speed of 3000rpm. After it was installed, it vibrated with large amplitude at operating speed. What dynamic vibration absorber should be coupled to the system if the nearest resonant frequency of the combined system has to be at least 25% from the operating speed.

5. Explain Dunkerley's method with suitable example used in muti-degree of freedom system.

6. A bar of length L is fixed at one end and connected at the other end by a spring of stiffness 'K' as shown in fig. Derive suitable expression of motion for longitudinal vibration.



SECTION-C

7. A vibratory system performs the motion as expressed by the following equation:

$$\ddot{x} + 800x + 90\theta = 0,$$

$$\ddot{\theta} + 800\theta + 90x = 0$$

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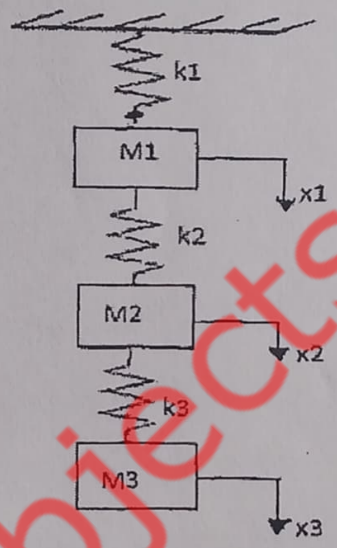
If the system is turned through 1.5 radians and released, find the frequencies and mode shapes.

8. A spring-mass system with mass *m* kg and stiffness '*k*' N/m has a natural frequency of '*f*' Hz. Determine the value of the stiffness '*k*' of another spring which when arranged in conjunction with spring of stiffness *k* in series will lower the natural frequency by 20% and in parallel will raise the natural frequency by 20%.

9. Use Stodola's method to determine the natural frequency of spring mass system as shown in fig.



Assume $m_1 = m_2 = m_3 = m$ and $k_1 = k_2 = k_3 = k$

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NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC case against the Student.