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GAIN MORE KNOWLEDGE
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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST - 1

Even Semester: 2018-19 | **Date**: 01 March 2019

Course Code: MEC212 | **Time**: 1 Hour

Course Name: Mechanical Vibration | **Max Marks**: 40

Programme & Sem: B.Tech.(MEC) & VI Sem | **Weightage**: 20%

Instructions:

(i) *Read the question properly and answer accordingly.*

(ii) *Question paper consists of 3 parts.*

(iii) Scientific and Non-programmable calculators are permitted.

Part A

Answer All the Questions. **Each** question carries **Four** marks. (4Qx4M=16)

1. Explain in brief different types of damping used in mechanical system.
2. Define logarithmic decrement. Derive the logarithmic decrement in terms of damping factor for successive cycle and 'n' number of cycles.
3. Add two harmonics analytically and graphically whose components are given as $x_1=6 \sin (4t+30^0)$ and $x_2=4 \cos (4t+ 20^0)$.
4. Find the natural frequency of the system shown in figure.1

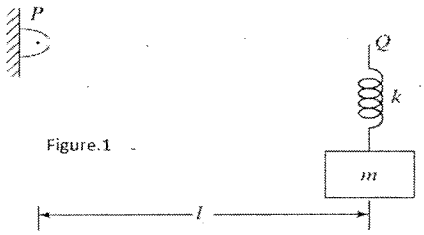

Figure.1

Part B

Answer **both** the Questions. **Each** question carries **six** marks. (2Qx6M=12)

5. Derive the equation of motion for the following system shown in fig.2 and determine the natural frequency.

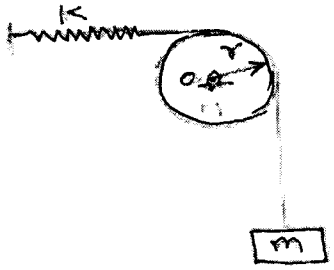

Figure.2

6. Derive the equation of motion for the following system shown in fig.3 and determine the natural frequency.

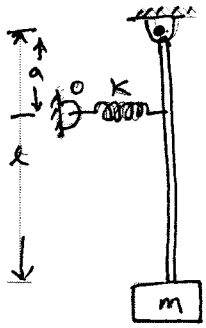

Figure.3

Part C

Answer **both** the Questions. **Each** question carries **six** marks. (2Qx6M=12)

7. A vibrating system is defined by the following parameters: m= 3 kg , k= 100 N/m, C= 3 N-s/m Determine (a) the damping factor , (b) the natural frequency of damped vibration (c) logarithmic decrement, (d) the ratio of two consecutive amplitudes and (e) the number of cycles after which the original amplitude is reduced tor 20 percent
8. A spring mass damper system having mass 5 kg and stiffness of spring 1000 N/m having amplitude ratio of successive cycles is 1.5:1. Determine the logarithmic decrement, critical damping coefficient, damping ratio, amplitude ratio of after 5 cycles.

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BENGALURU

SCHOOL OF ENGINEERING

TEST - 2

Even Semester: 2018-19 | **Date**: 13 April 2019

Course Code: MEC 212 | **Time**: 1Hour

Course Name: Mechanical Vibrations | **Max Marks**:40

Program &Sem: B.Tech & VI Sem | **Weightage**:20%

Instructions:

(i) ***Answer all the Questions***

(ii) ***Non Programmable calculators are only allowed***

(iii) ***Read the Questions carefully before attempting***

Part A

Answer **all** the Questions. **Each** question carries **four** marks. (4Qx4M=16)

1. With a neat sketch and equation, explain seismic instrument.
2. Define transmissibility ratio with equation and Magnification factor.
3. Derive the equation of the motions for the system shown in Fig .3

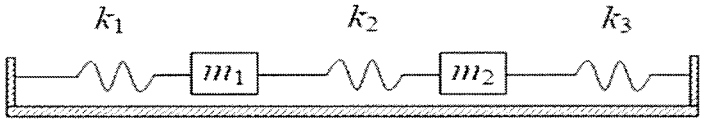

Fig.3

4. A vibrometer having the amplitude of vibration of the machine part as 4 mm and Damping factor 0.2 performs harmonic motion. If the difference between the Maximum and minimum recorded value is 10 mm, determine the natural frequency of vibrometer if the frequency of vibration part is 12 rad/sec.

Part B

Answer **both** the Questions. **Each** question carries **eight** marks. (2Qx8M=16)

5. A block of mass 50kg is connected to the floor through a spring with k =1.5×10^6 N/m and a damper with C=2000 N-s/m. The floor vibrates with an amplitude of 10 mm at a frequency of 30 Hz. Find (a) The amplitude of absolute displacement (b) The relative displacement amplitude of the block.

6. The rotor of a turbo super charger weighing 9 kg is keyed to the centre of a 25 mm diameter steel shaft 0.4 m between bearings. Determine:
   a) The critical speed of shaft,
   b) The amplitude of vibration of the rotor at a speed of 3200 rpm, if the eccentricity is 0.015 mm and
   c) The vibratory force transmitted to the bearings at this speed. Assume the shaft to be Simply supported and E= 2.1×10^{11} N/m.

Part C

Answer the Question. The Question carries **six** marks. (1Qx8M=8)

7. A 4kg mass is suspended in a box by a spring. The box is placed on a platform having vibration y=8sin8t.Determine the absolute amplitude of the mass. Assume no damping.

4. a. Explain the experimental modal analysis and necessary basic equipment.

b. Solve the problem shown in Fig.2 m_1=10kg,m_2=15 kg, and K=320N/m

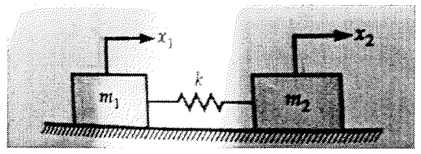

Fig 2

Part C

Answer **both** the Questions. **Each** question carries **fifteen** marks. (2Qx15M=30M)

5. Determine the natural frequency and the mode shape of the system shown in Fig 3 by Holzer's method.m_1=2 Kg ,m_2=4 Kg m_3=2 Kg, k_1=5N/m , k_2=10N/m

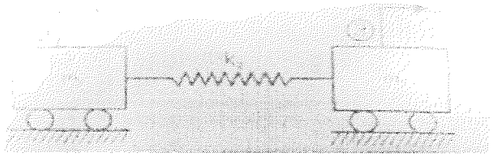

Fig.3

6. a) A shaft of 50 mm diameter and 3m long is supported at the ends and carries 3 weights 1000N, 1500N, 750N at 1m, 2m, 2.5m from the left support as shown in Fig.4. Taking E=200Gpa.Find the frequency of transverse Vibrations using **Dunkerley's method.**

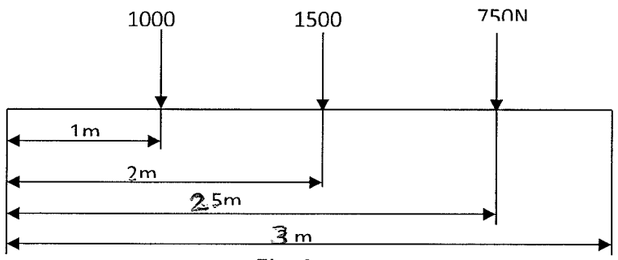

Fig.4

b) Using **Stodola** method, determine the fundamental mode of vibration of the system as shown in Fig.4 Given m=2.K=20.Fig 5

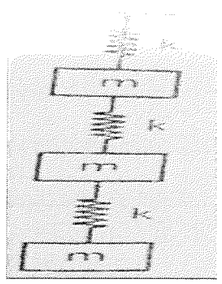

Fig.5

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BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Even Semester: 2018-19 **Date**: 21 May 2019

Course Code: MEC 212 **Time**: 3 Hours

Course Name: Mechanical Vibrations **Max Marks**: 80

Program & Sem: B.Tech & VI Sem **Weightage**: 40%

Instructions:

(i) Answer all the Questions
(ii) Non Programmable calculators are only allowed
(iii) Read the Questions carefully before attempting
(iv) Assume suitable missing data

Part A

1. Answer **all** the Questions. **Each** question carries **one** mark. (20Qx1M=20M)

i. What are deterministic vibrations?
a. Vibrations caused due to known exciting force
b. Vibrations caused due to unknown exciting force
c. Vibrations which are a periodic in nature
d. None of the above

ii. Two springs have spring stiffness of 1500 N/m and 2000 N/m respectively. If they are connected in series, what is the spring stiffness if they are replaced by an equivalent system.
a. 3500 N/m b. 1166 N/m c. 857.63 N/m d. None of the above

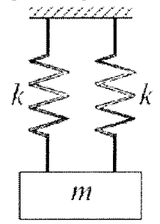
iii. The fundamental natural frequency of a system is
a. the largest value b.Smallest Value c. any value d.Zero

iv. For a critically damping system, the motion will be:
a. periodic b. aperiodic c. harmonic d. Non harmonic

v. A single-degree-freedom spring-mass is subjected to a sinusoidal force of 10 N amplitude and frequency ω along the axis of the spring. The stiffness of the spring is 150 N/m, damping factor is 0.2 and undamped natural frequency is 10 ω. At steady state, the amplitude of vibration (in m) is approximately
a. 0.05 b. 0.07 c. 0.70 d.0.90

vi. In a single degree of freedom underdamped spring-mass-damper system as shown in the figure, an additional damper is added in parallel such that the system still remains underdamped. Which one of the following statements is ALWAYS true?
a. Transmissibility will decrease b. Time period of free oscillations will decrease.
c. Transmissibility will increase. d. Time period of free oscillations will increase.

vii. A mass *m* is attached to two identical springs having constant *k* as shown in the figure. The natural frequency ω of this single degree of freedom system is



a. $\sqrt{\frac{k}{m}}$ b. $\sqrt{\frac{2k}{m}}$ c. $\sqrt{\frac{k}{2m}}$ d. $\sqrt{\frac{4k}{m}}$

viii. What is meant by coupled differential equation?

a. The differential equation in which only rectilinear motions exist\
b. The differential equation in which only angular motions exist
c. The differential equation in which both rectilinear and angular motions exist
d. None of the above

ix. Consider a single degree-of-freedom system with viscous damping excited by a harmonic force. At resonance, the phase angle (in degree) of the displacement with respect to the exciting force is

a. 0^0 b. 45^0 c. 90^0 d.135^0

x. A vibrometer indicates 2 percent error in measurement and its natural frequency is 5 Hz. If the lowest frequency that can be measured is 40Hz, then the value of damping factor is

a. 0.0531 b. 0.9922 c. 0.35 d. 0.0028

xi. Transmissibility is the ratio of
a. force transmitted and existing force
b. force applied and the resulting displacement
c. applied force and displacement
d. resulting displacement and force transmitted

xii. The instrument that measures the displacement of a vibrating body is called
a. vibrometer b. transducer c. accelerometer d. stroboscope

xiii. Modal analysis can be used conveniently to find the response of a multi degree-of freedom system
a. under arbitrary forcing conditions
b. under free-vibration conditions
c. involving several modes
d. none of the above

xiv. For a definite system, the final equation in Holzer's method denotes the
a. amplitude at the end as zero
b. sum of inertia forces as zero
c. equation of motion
d. sum of the displacement as zero

xv. In Matrix Iteration method solving for natural frequencies of the system gives
a. Finds the natural frequencies and mode shapes of the system, one at a time using several trial Values for each frequency
b. Finds all the natural frequencies using trial vectors and matrix deflation procedure
c. Finds all the eigenvalues and eigenvectors simultaneously without using trial vectors
d. Finds the approximate value of the fundamental frequency of a composite system.

xvi. A rotor of mass 12 kg is mounted in the middle of 25 mm diameter shaft supported between two bearings placed at 900 mm from each other. The rotor is having 0.02 mm eccentricity. If the system rotates at 3000 rpm, if young's modulus is $2x10^{11}$ N/m^2 the dynamic force on the bearings is
a. 3.206 N b. 6.412N c. 1.603N d. 2.03 N

xvii. The rotor shaft of large electric motor supported between short bearings at both ends shows a deflection of 1.8 mm in the middle of the rotor. Assuming the rotor to be perfectly balanced and supported at knife edges at both the ends, the likely critical speed (in rpm) of the shaft is
a. 350 b. 705 c. 2810 d. 4430

xviii. The response of an undamped system under resonance will
a. Very large b. Infinity c. Zero d. very small

xix. What is meant by node point?
a. The point at which amplitude of vibration is maximum
b. The point at which amplitude of vibration is minimum
c. The point at which amplitude of vibration is zero
d. None of the above

xx. A Vibrating machine is isolated from the floor using springs. If the ratio of excitation Frequency of vibration of machine to the natural frequency of the isolation system is equal to 0.25, the transmissibility ratio of isolation is
a) ½ b) ¾ c) 16/15 d) 2

Part B

Answer **all** the Questions. **Each** question carries **ten** marks. (3Qx10M=30M)

2. a) Find the influence coefficients of the system shown in Fig.1 -------- (4M)

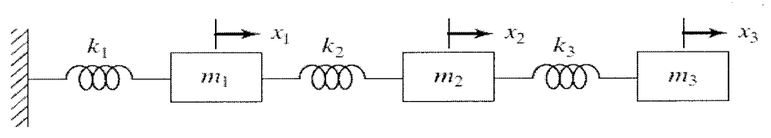


Fig.1

b) Explain with a neat sketch Piezoelectric transducer. -------- (6M)

3. a. Explain the working principle of Dynamic Vibration Absorber with a neat sketch

b. A vibrometer gives a reading relative displacement 0.5 mm .The natural frequency of vibration is 600 rev/min and the machine runs at 200 rev/min. determine the magnitude of displacement, velocity and acceleration of the vibrating machine part.

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SCHOOL OF ENGINEERING

SUMMER TERM / MAKE UP ENDTERM EXAMINATION

Semester: Summer Term 2019 | **Date**: 24 July 2019

Course Code: MEC 212 | **Time**: 3 Hours

Course Name: Mechanical Vibrations | **Max Marks**: 80

Program & Sem: B.Tech. & VI Sem (2015 Batch) | **Weightage**: 40%

Instructions:

(i) ***All questions are compulsory.***

Part A

Answer **all** the Questions. **Each** question carries **six** marks. (3Qx6M=18)

1. What is the importance of vibration measurement?
2. Explain the principle of dynamic vibration absorber.
3. Explain: 1. Vibration Pick-ups and 2. Vibration Exciters.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks. (3Qx10M=30)

4. Determine the natural frequency of the given mechanical system in figure 1 below.

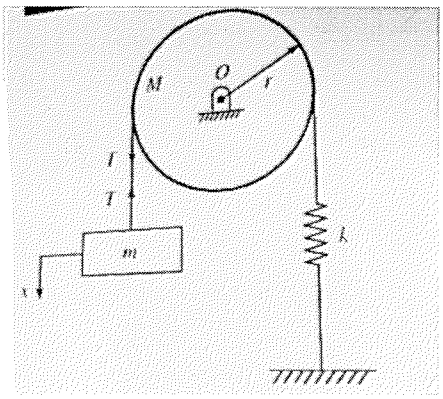

Figure 1

5. Find the lower natural frequency for the system shown in Figure 2. below by Dunkerley's method. Take E = $2x10^{11}$ N/m^2 and I = $4x10^{-7}$ m^4

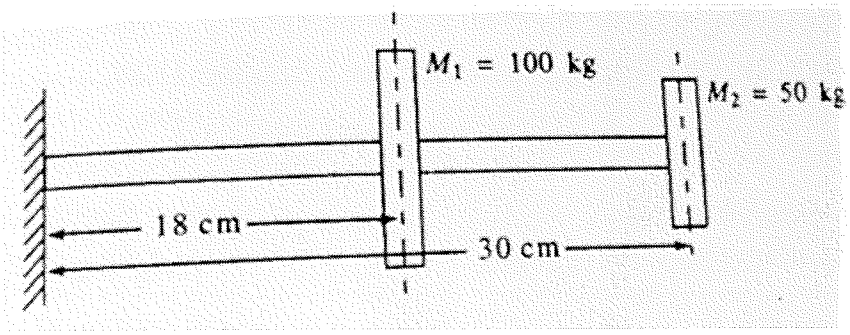

Figure 2

6. Explain experimental modal analysis and the necessary basic equipment.

Part C

Answer **both** the Questions. **Each** question carries **sixteen** marks. (2Qx16M=32)

7. Determine the natural frequencies of the system shown in Figure 3. below using Holzer's method.

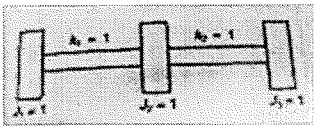

Figure 3

8. Find the fundamental natural frequency of vibration for the system of the system as shown in Figure 4. below by Stodola method.

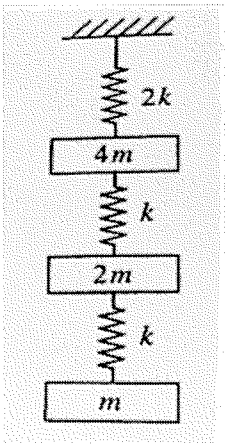

Figure 4