

JK LAKSHMIPAT UNIVERSITY, JAIPUR
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November-December 2015

B. Tech in Mechanical Engineering, Semester VII

Roll No.....

COURSE CODE: ME-701 Mechanical vibration and control

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever required are an integral part of the answer.

Q.1A Objective type questions (10 questions @ 1 mark)

10

1. The natural frequencies of continuous system depend on its
(a) Boundary conditions only (b) Initial condition only
(c) Both boundary and initial conditions (d) none of these
2. For a mechanical system, the dynamic matrix is
(a) always symmetric (b) Always non symmetric
(c) Sometimes skew symmetric (d) generally non symmetric.
3. Decoupling of a system can be done because of
(a) Orthogonality of Eigen vectors (b) orthonormality of eigenvectors
(c) Expansion theorem (d) all of these
4. The effective mass of a simple supported beam during its transverse vibration is
(a) $\frac{1}{2}$ of its total mass
(b) $\frac{13}{35}$ of its total mass
(c) $\frac{17}{57}$ of its total mass
(d) $\frac{17}{35}$ of its total mass
5. Viscous damping present in a system leading to a periodic motion is known as
(a) Under damping (b) critical damping
(c) Over damping (d) None of these
6. Transient response is due to
(a) suddenly applied force
(b) non periodic excitation
(c) both a and b
(d) none of the above
7. Vibration transmission is effective at a frequency ratio
(a) less than $\sqrt{2}$ (b) At $\sqrt{2}$
(c) more than $\sqrt{2}$ (d) Cannot be said definitely.
8. Response spectrum is a plot of
(a) maximum displacement vs frequency
(b) Maximum velocity vs frequency
(c) Maximum acceleration vs frequency

(d) All of these

9. A non linear pendulum will have amplitude depending on

- (a) time period (b) phase angle
(c) both a and b (d) None of these.

10. A periodic odd function, when expressed in Fourier series will have

- (a) Odd harmonic (b) Even harmonic
(c) Both a and b (d) None of the above

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

- (a) Define Rayleigh Principle.
(b) What do you mean by whirling of the shaft?
(c) Explain Vibrations and its types.
(d) Explain degree of freedom and constraint.

Q.3A Give the comparative analysis of viscous and columbic damping.

05

Q.3B A spring mass system k_1 , m has a natural frequency $=f_1$. If a second spring k_2 is added in series with the first spring, the natural frequency is lowered by $1/2 f_1$. Determine k_2 in terms of k_1 .

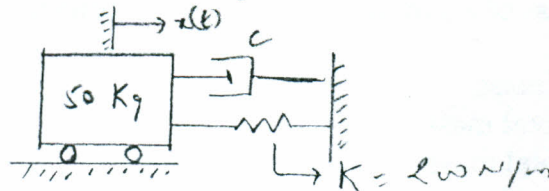
05

Q.4A For a viscously damped system excited by a harmonic force, $F=F_0 \sin \omega t$, the resonating amplitude is found to be 5.8mm. At 80% of the resonating frequency the amplitude is observed as 4.6mm. Calculate the damping factor for the system from the above observed data.

05

Q.4B The mass of the system shown in fig is released from the condition of rest at $x_0=150\text{mm}$ initially. Calculate the displacement of the mass at $t=0.5\text{secs}$ if $c=200\text{N.s/m}$.

05



Q.5A Derive the expression for energy dissipated to viscous damping in forced vibration.

05

Q.5B What is logarithmic decrement factor? Derive the expression for logarithmic decrement factor in damped free vibration

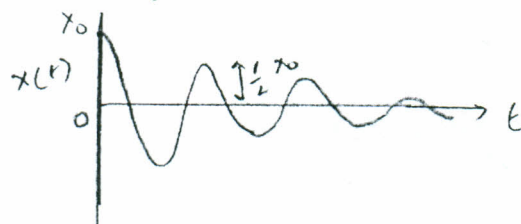
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Q.6A What are absorbers? Elaborate one its type.

05

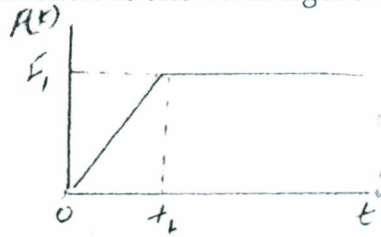
Q.6B A damped spring mass system is released from rest from a positive initial displacement X_0 . If the succeeding positive amplitude is $1/2 X_0$ calculate the damping ratio of the system.

05



OR

- Q.6B Consider the undamped SDOF system, initially in the static equilibrium, being subjected to a forcing function as shown in figure. Calculate the response. 05



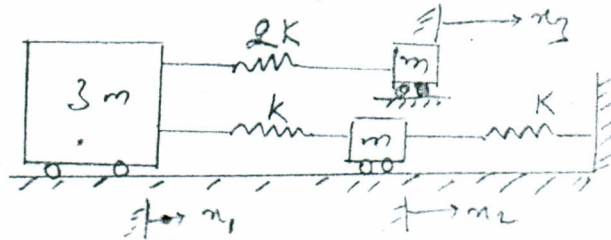
- Q.7A Explain multiple degree of vibration with diagrams. 05

- Q.7B Formulate the equations of motion for multiple degrees of freedom (force method). 05

OR

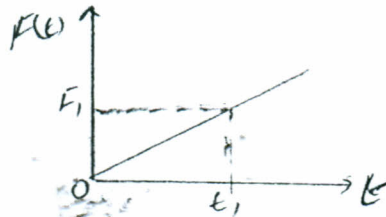
- Q.7B Explain Holzers method. 05

- Q.8A Figure shows a branched system. Find the equations of motion and represent them in a matrix format. Also find its dynamic matrix $[A]$. 10



- Q.9A Explain free vibration Continuous system with diagram. Derive a hyperbolic partial differential equation in x and t for tightly stretched string. 10

- Q.9B An undamped system is subjected to a ramp type forcing function as shown in figure. Find the response of the system. 10



OR

- Q.9B Consider a finite rectangular pulse type forcing as shown in fig is applied to an undamped SDOF system. Calculate the response of the system as a function of time. 10

