PAPER ID-310357

Roll No:

BTECH
(SEM V) THEORY EXAMINATION 2024-25
MECHANICAL VIBRATIONS
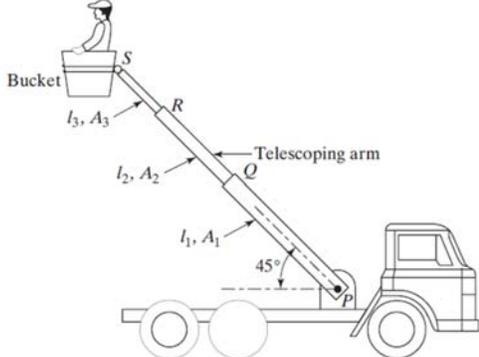
TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** **2 x 07 = 14**

Q no.	Question	CO	Level
a.	Distinguish between periodic motion and harmonic motion.	1	K2
b.	What do you mean by the degree of freedom?	2	K3
c.	Define Energy dissipation in viscous damping?	2	K3
d.	State Orthogonality Principle.	3	K4
e.	What do you mean by static coupling?	4	K4
f.	Define Whirling of uniform shaft?	4	K4
g.	What are Vibration isolators?	5	K3

SECTION B

2. **Attempt any *three* of the following:** **07 x 3 = 21**

a.	Differentiate between Torsional vibrations and Damped vibrations with suitable example?	1	K2
b.	Define acceleration measuring instruments with suitable diagram?	2	K3
c.	Discuss Holzer's method for finding the natural frequencies of multi-rotor vibrating systems.	3	K4
d.	Explain the working of the Centrifugal pendulum absorbers in detail with a schematic diagram.	4	K4
e.	A rotor having a mass of 5 kg, is mounted midway on a 0.01m dia shaft supported at the ends by two bearings. The bearing span is 0.40m. Because of certain manufacturing in accuracies, the C. G. of the disc is 0.02 mm away from the geometric centre of the rotor. If the system rotates at 3000 r.p.m. find the amplitude of steady state vibrations and the dynamic force transmitted to the bearings. Neglect damping. Take E = 1.96 x 10^{11} N/m^2.	5	K3

SECTION C

3. **Attempt any *one* part of the following:** **07 x 1 = 07**

a.	The cockpit of a firetruck is located at the end of a telescoping boom, as shown in Fig. The cockpit, along with the fireman, weighs 2000 N. Find the cockpit s natural frequency of vibration in the vertical direction.	1	K2
b.	Define Energy dissipation in viscous damping?	1	K2

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4.	**Attempt any *one* part of the following:**	**07 x 1 = 07**	
a.	A heavy machine, weighing 3000 N, is supported on a resilient foundation. The static deflection of the foundation due to the weight of the machine is found to be 7.5 cm. It is observed that the machine vibrates with an amplitude of 1 cm when the base of the foundation is subjected to harmonic oscillation at the undamped natural frequency of the system with an amplitude of 0.25 cm. Find (a) the damping constant of the foundation (b) the dynamic force amplitude on the base, and (c) the amplitude of the displacement of the machine relative to the base.	2	K3
b.	Explain with a neat sketch the working principle of displacement measuring instruments.	2	K3
5.	**Attempt any *one* part of the following:**	**07 x 1 = 07**	
a.	Find the initial conditions that need to be applied to the system shown in Fig. to make it vibrate in (a) the first mode, and (b) the second mode.	3	K4
b.	Define Torsional vibration absorber and centrifugal pendula absorber? Also give the difference between them?	3	K4
6.	**Attempt any *one* part of the following:**	**07 x 1 = 07**	
a.	Find the lower natural frequency of vibration for the system shown in Fig. by Rayleigh's method. Assume $E = 1.96 \times 10^{11}$ N/m^2, $I = 4.0 \times 10^{-7}$ m^4	4	K4
b.	Define Torsional vibrations of circular shafts.	4	K4
7.	**Attempt any *one* part of the following:**	**07 x 1 = 07**	
a.	Define Shaft with one disc with and without damping?	5	K3
b.	Define Introduction to the vibration analysis using MATLAB.?	5	K3