Hall Ticket Number:

Code No. : 21815

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

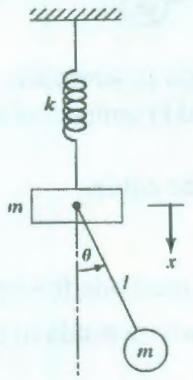
M.E. (Mech. Engg.: CBCS) I-Semester Main Examinations, January-2019

(Advanced Design & Manufacturing)

Mechanical Vibrations

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Q. No	Stem of the Question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	What is a mode shape? How is it computed?	2	3	1	2,6
2.	What is a rigid body mode? How is it determined?	2	1	1	2,6
3.	Interpret the effect of a tensile force on the natural frequencies of a beam.	2	2	1	2,6
4.	How does a continuous system differ from a discrete system in the nature of its equation of motion?	2	4	1	2,6
5.	What is a frequency response function?	2	1	2	2,6
6.	Contrast circle fitting from curve fitting.	2	3	2	2,6
7.	Explain the function of a vibration isolator.	2	4	4	2,6
8.	What is the purpose of experimental modal analysis?	2	5	4	2,6
9.	Describe spectral density.	2	1	3	2,6
10.	What is an impulse response function?	2	1	5	2,6
	Part-B (5 × 8 = 40 Marks)				
11. a)	Develop the equations of motion of the system shown in Fig. by using Lagrange's equations with x and Θ as generalized coordinates. 	4	5	1	2,6
b)	The mass and stiffness matrices of an airplane in flight, with a three-degree-of-freedom model for vertical motion are given by $[m] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ *and* $[k] = \begin{bmatrix} 3 & -3 & 0 \\ -3 & 6 & -3 \\ 0 & -3 & 3 \end{bmatrix}$ Determine the highest natural frequency of vibration of the airplane using the matrix iteration method.	4	6	2	2,6

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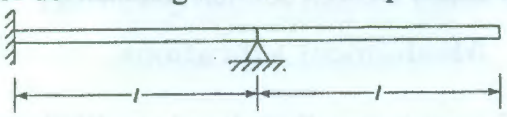
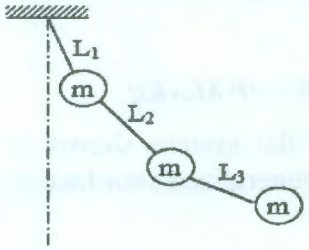
12. a)	A uniform beam of length 2l is fixed at the left end, supported on a simple support at the middle, and free at the right end as shown in Fig. Derive the frequency equation for determining the natural frequencies of vibration of the continuous beam. 	4	4	2	2,6
b)	Calculate the natural of frequencies of Torsional vibration for a shaft fixed at both ends.	4	5	2	2,6
13. a)	For a single degree of freedom system, explain peak amplitude method.	4	3	3	2,6
b)	Summarize the procedure of multi curve fitting in time domain for multi degree of freedom system.	4	3	3	2,6
14. a)	What is vibration exciter? Outline the Electro-dynamic shaker with neat sketch.	4	4	4	2,6
b)	A steel shaft of diameter 2.5 cm and length 1 m is supported at the two ends in bearings. It carries a turbine disc, of mass 20 kg and eccentricity 0.005 m, at the middle and operates at 6000 rpm. The damping in the system is equivalent to viscous damping with $\zeta = 0.01$. Determine the whirl amplitude of the disc at (i) operating speed, (ii) critical speed, and (iii) 1.5 times the critical speed.	4	6	4	2,6
15. a)	Explain about stationary, random and variable processes.	4	3	3	2,6
b)	What is Chaotic Behavior of Duffing's equation with the forcing Term?	4	2	5	2,6
16. a)	Determine the influence coefficients for the triple pendulum shown in Fig. 	4	6	1	2,6
b)	A cable of length l and mass ρ per unit length is stretched under a tension P. One end of the cable is fixed and the other end is connected to a pin, which can move in a frictionless slot. Find the natural frequencies of vibration of the cable.	4	6	1	2,6
17.	Answer any ***two*** of the following:				
a)	Explain any two modal parameter extraction methods for non-linear systems.	4	3	3	2,6
b)	What is condition monitoring? Explain any two methods to diagnose the faults of machines.	4	2	4	2,6
c)	Find the autocorrelation function of a random process whose power spectral density is $S(\omega) = S_0$ is constant between the frequencies ω_1 and ω_2.	4	6	3	2,6

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	55
2	Knowledge on application and analysis (Level-3 & 4)	35
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	10