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VII SEMESTER B.TECH. (AERONAUTICAL & AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, DECEMBER 2020

SUBJECT: THEORY OF VIBRATION [AAE 4101]

REVISED CREDIT SYSTEM (00/12/2020)

Duration: 3 Hours

Max. Marks: 50

Instructions to Candidates:

Answer all the questions.

✤ Assume missing data if any.

1A)	Differentiate between a) deterministic and non-deterministic vibrations and b) linear and non-linear vibration.	(02)
1B)	Determine the natural frequency of the following system (figure 1)for small amplitudes.	(03)
	Figure 1	
1C)	A chronograph is to be operated by a 2 sec pendulum of length <i>L</i> as shown below. A platinum wire attached to the bob completes the electric timing circuit through a drop of mercury as it swings through the lowest point. (a) what should be the length of the pendulum? (b) If the platinum wire is in contact with the mercury for 0.3175 cm of the swing, what must be the amplitude θ to limit the duration of contact to 0.01 sec? (Assume that the velocity during contact is constant and that the oscillation is small).	(05)

	5.08 cm + 0.317 cm Figure 2	
2A)	A mass of 0.907 kg is attached to the end of a spring with constant of 7 N/cm. Determine the	(02)
2B)	Critical damping coefficient.	(03)
20)	damping coefficient for the same.	(05)
2C)	A weight attached to the spring of stiffness 525 N/m has a viscous damping device. When the weight is displaced and released, the period of vibrations was found to be 1.8 sec. and the ratio of consecutive amplitudes is 4.2 to 1.0. Determine the phase and amplitude when a force $f(t) = 3 \cos(3t)$ acts on the system.	(05)
3A)	A sensitive instrument with a mass of 113 kg is to be installed where the acceleration is 15.24 (cm/sec2 and a frequency of 20 Hz. It is proposed to mount the instrument on a rubber pad with stiffness of 2802 N/cm and ζ =0.1. What acceleration is transmitted to the instrument?	
3B)	Derive the equation governing the longitudinal vibrations of the bar and obtain the (0 general solution of the differential equation derived above	
4A)	What do you understand by normal mode and principal mode of vibration?(i	
4B)	Differentiate between definite and semidefinite systems.	
4C)	Figure shows a system of two masses attached to a tightly stretched string, fixed at both ends. Determine the natural frequencies and any one mode shape of the system for m_1 = m_2 = m and $l_1 = l_2 = l_3 = l$.	(06)

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 5A) What is the differe 5B) Determine the natu (Carry out only two 	Figure 4 Figure 4 ance between generalized coordinates and Cartesian coordir ural frequencies of the system shown in figure using Stodola's to iterations)	nates? (02) 5 method. (06)			
	Figure 5				
5C) Briefly explain the st					