Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

END SEMESTER EXAMINATIONS, DECEMBER 2020

SUBJECT: THEORY OF VIBRATION [AAE-4101]

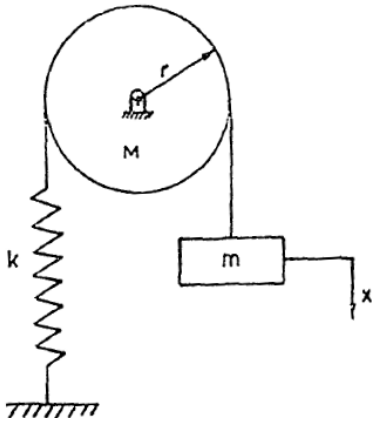
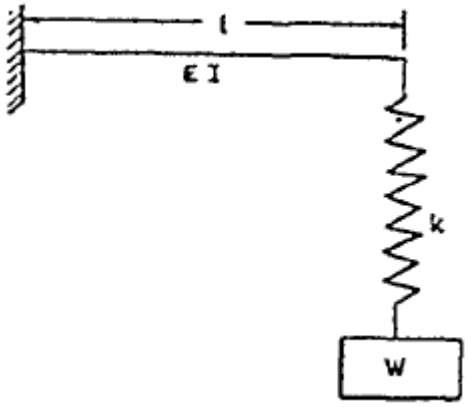
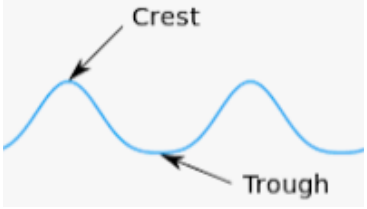
REVISED CREDIT SYSTEM

(23/12/2020)

Duration: 3 Hours Max. Marks: 50

Instructions to Candidates:

- **Answer all the questions.**
- **Assume missing data if any.**

1A)	An accelerometer indicates that acceleration of a body is sinusoidal at 40 Hz. If the maximum acceleration is 100 m/s2 find the average and RMS value of displacement amplitude.	**(02)**
1B)	Determine the natural frequency of the following systems (figure 1and figure 2) for small amplitudes.  Figure 1  Figure 2	**(05)**
1C)	Derive the expression to determine the ratio of the first crest to first trough of the time domain graph of a viscous damped system.  	**(03)**

2A)	How large a weight must be kept at the end of the reed tachometer made of spring steel 0.1016 cm thick, 0.635 cm thick and 8.89 cm long for a natural frequency of 20 cps.	**(02)**
2B)	A body of mass M=1 kg mass lies on a horizontal surface and is connected by a spring to rigid surface. The body is displaced from the unstressed position by 0.255 m with the tension in the spring at this displacement equal to 5 Mg. and then released with zero velocity. How long will the body vibrate and at what distance from the unstressed position will it stop if the coefficient of friction is 0.25.	**(03)**
2C)	An aircraft radio of 106.75 N is to be isolated from engine vibrations ranging in the frequencies from 1600 cpm to 2200 cpm. What statical deflection must the isolators have for 85% isolation?	**(05)**
3A)	A counterrotating eccentric weight exciter is used to produce the forced oscillations of a spring supported mass as shown below. By varying the speed of rotation, the resonant speed of 0.6 cm was recorded. When the speed of the rotation was increased considerably beyond the resonance, the amplitude was converging to 0.08 cm. Determine the damping ratio.	**(03)**
3B)	A composite material beam was prepared in the lab by dispersing natural fiber in an epoxy matrix. How to determine the damping property of the prepared sample?	**(02)**
3C)	Derive the equation governing the lateral vibrations of the string and obtain the general solution of the differential equation derived above.	**(05)**
4A)	What do you understand by Coordinate coupling?	**(02)**
4B)	How many degrees of freedom does an airplane in flight have if it is treated as (a) a rigid body, and (b) an elastic body?	**(02)**
4C)	Determine the natural frequencies of the system shown in figure 3 by assuming that the rope passing over the cylinder does not slip.	**(06)**

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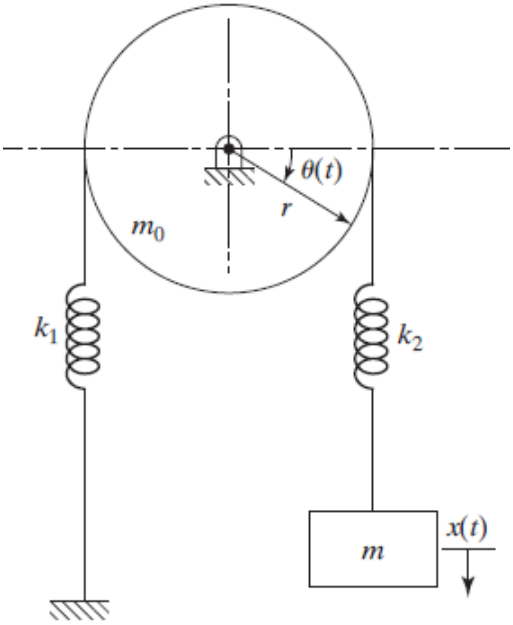
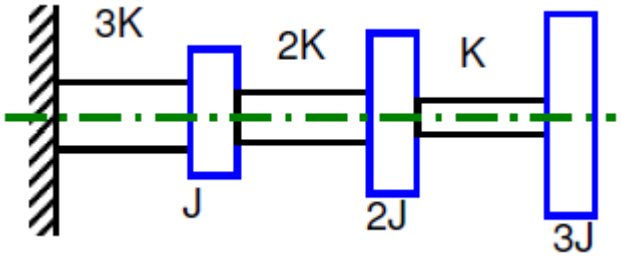
	 Figure. 3	
5A)	Define the flexibility and stiffness influence coefficients. What is the relation between them?	**(02)**
5B)	Estimate the first two natural frequencies of the system shown in figure 4 using Holzer's method.  Figure. 4	**(06)**
5C)	What is the main drawback of Stodola's method?	**(02)**