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Roll No....

Total No. of Questions : 09]

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Paper ID [A0841]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 7th/8th)

MECHANICAL VIBRATIONS (ME - 408)

Time : 03 Hours Instruction to Candidates:

Maximum Marks: 60

 $(10 \times 2 = 20)$

- 1) Section A is Compulsory.
- 2) Attempt any Four questions from Section B.
- 3) Attempt any Two questions from Section C.

Section - A

Q1)

- a) What do you mean by vibration?
- b) What types of stresses are produced in case of free-vibration of different types?
- c) What is difference between discrete system and continuous system?
- d) Explain torsional vibration.
- e) Define the term elastic line of the shaft.
- f) What is self excited vibration?
- g) Define the flexibility and stiffness influence coefficient.
- h) Why is damping considered only in the neighborhood of resonance in most cases?
- i) Define proportional damping and modal damping ratio.
- j) What is critical damping and discuss its importance.

Section - B

$$(4 \times 5 = 20)$$

Q2) Obtain the equation of the system shown in Fig.1



Fig. 1

E-506[1208]

P.T.O.

Q3) What is importance of vibration measurement? What is a transducer?

Q4) Use free body diagram method to derive the differential equations governing the motion of the system of Fig.2 using x1, x2 and x3 as generalized coordinates.



- Fig. 2
- **Q5)** Consider a spring mass damper system with k = 4000 N/m, m = 10 kg, and c = 40 N-s/m. Find the steady state and total responses of the system under the harmonic force $F(t) = 200 \cos 10t$ N and the initial conditions $x_0 = 0.1$ m and $x_0 = 0$.
- Q6) Find the damping factor of a vibrating system which consist of a mass of 3.5 kg a spring stiffness 2.5 N/mm and a damper of damping coefficient 0.018 N/mm/s. What is the natural frequency of damped vibration.

Section - C

 $(2 \times 10 = 20)$

- Q7) A uniform fixed-fixed beam of length 2L is simply supported at the middle point. Derive the frequency equation for the transverse vibration of beam.
- **Q8)** A 200 kg turbine operates at speed between 1000 and 2000 rpm. The turbine has a rotating unbalance of 0.25 kg-m. What is the required stiffness of an undamped isolator such that the maximum force transmitted to turbines foundation is 1000 N?
- Q9) Find the natural frequencies for torsional vibration of fixed-fixed shaft?