Roll No.

Total No. of Questions : 09

B.Tech. (ME) (2011 Onwards)   (Sem.–7,8)
MECHANICAL VIBRATIONS
Subject Code : BTME-803
M.Code : 71996

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

INSTRUCTIONS TO CANDIDATES :
1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. **Answer briefly :**

a) Define harmonic series.

b) What is time period?

c) What is logarithmic decrement?

d) Define semi definite system.

e) What is transverse vibration?

f) Define eigen value.

g) What is a continuous system?

h) Define principal mode of vibration.

i) Write two uses of vibration.

j) Write one advantage of critical damping.

SECTION-B

Q2. An instrument has a natural frequency of 10 Hz. It can stand a maximum acceleration of 10m/s^2. Find maximum amplitude of displacement.

Q3. A spring-mass system with mass m kg and stiffness k N/m has a natural frequency of 1Hz. Determine the value of stiffness k_1 of another spring which when arranged in conjunction with spring of stiffness k in series will lower the natural frequency by 20% and in parallel will raise the natural frequency by 20%.

Q4. Describe centrifugal pendulum vibration absorber.

Q5. Find the lowest natural frequency of transverse vibrations for the system shown in Fig. 1. By Rayleigh's method.
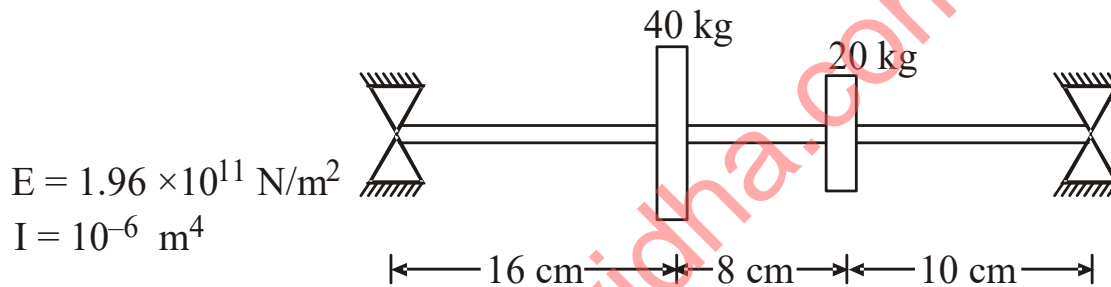
$$E = 1.96 \times 10^{11} \text{ N/m}^2$$
$$I = 10^{-6} \text{ m}^4$$

40 kg   20 kg

|← 16 cm →|← 8 cm →|← 10 cm →|

Fig. 1

Q6. Derive frequency equation for a beam with both ends free and having transverse vibration.

SECTION-C

Q7. An air craft radio weighing 118 N is to be isolated from engine vibrations ranging in frequencies from 1600 to 2200 epm. What static deflection must the isolator have for 85% isolation?

Q8. A gun barrel of mass 600 kg has a recoil spring of stiffness 294000 N/m. If the barrel recoils 1.3 m on firing, determine @ initial recoil velocity of the barrel and the time required for the barrel to return to a position 5cm from the initial position.

Q9. A four rotor system is represented in Fig. 2. Find the amplitude of vibration when the external torque acts on the first rotor.

$J_1 = 817$ kg-m^2

$J_2 = 608$ kg-m^2

$J_3 = 100$ kg-m^2

$J_4 = 120$ kg-m^2

$K_{t_1} = 30 \times 10^6$ N-m/rad

$K_{t_2} \; K_{t_3} = 42 \times 10^6$ N-m/rad

$T_0 = 12,000$ N-m

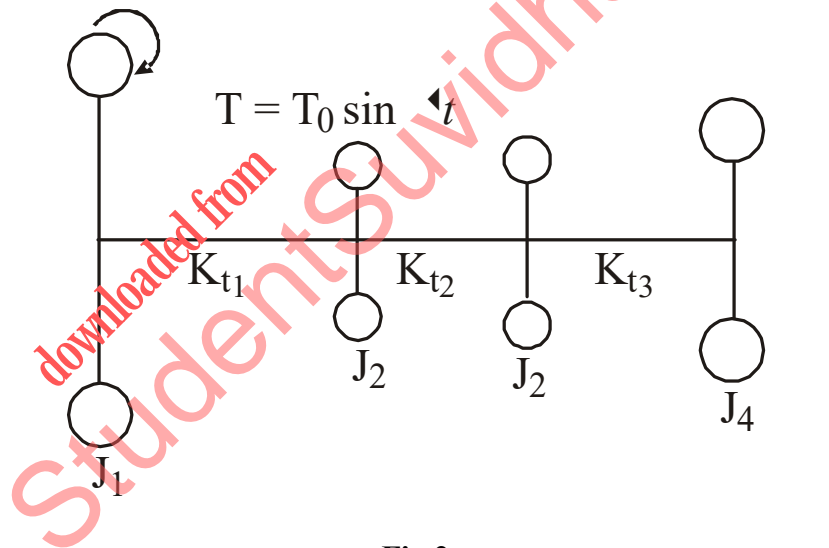$\omega = 200$ rad/sec

$$T = T_0 \sin \omega t$$

Fig.2

NOTE : Disclosure of identity by writing mobile number or making passing request on any page of Answer sheet will lead to UMC case against the Student.