Total No. of Questions : 10]

SEAT No. :

P4006

[Total No. of Pages : 3

[4860] - 102

M.E. (Mechanical) (Design Engineering)

VIBRATIONS AND NOISE CONTROL

(2008 Pattern)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates :

1) ***Answer any three questions from each section.***
2) ***Answer to the two sections should be written in separate book.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, whenever necessary.***

SECTION - I

Q1) Find the lower natural frequency of vibration for the beam shown beam shown in fig. 1 by Rayleigh's method. **[16]**
$E = 1.96 \times 10^{11}$ N/m^2, $I = 4 \times 10^{-7}$ m^4

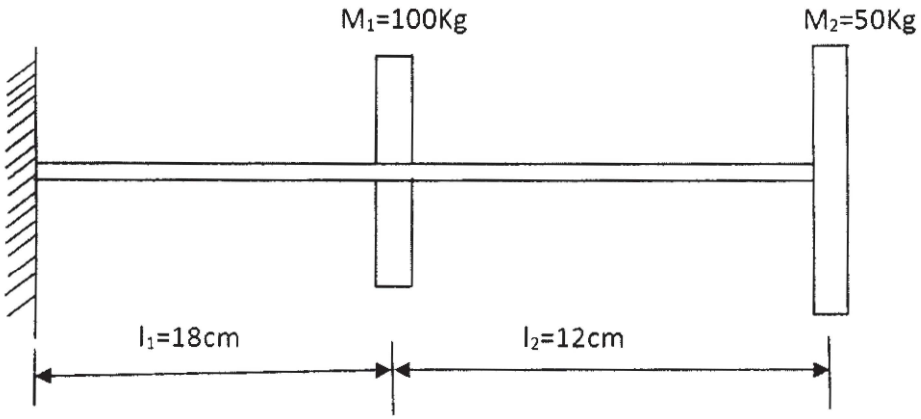

Fig.1

P.T.O.

Q2) Using holzer method find the natural frequency of the system shown in Fig. 2. Assume J = 10mm^4, K = 3 N/m. **[16]**

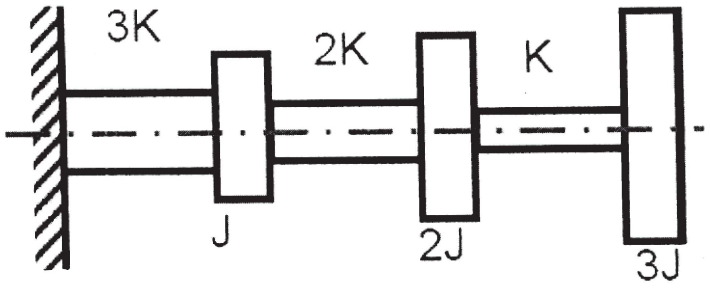

Fig.2

Q3) A uniform string of length l and a large initial tension S, stretched between two supports, is displaced laterally through a distance a_o at the centre as shown in fig. 3 and is released at t = 0. Find the equation of motion for the string. **[16]**

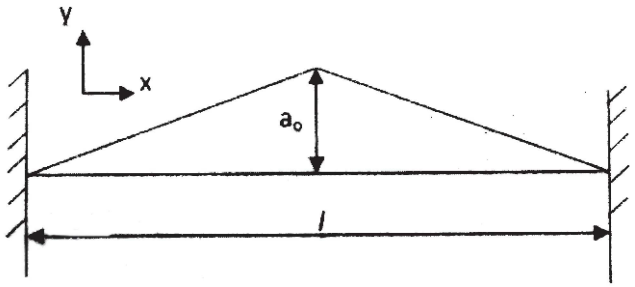

Fig. 3

Q4) Determine the forced response of the undamped single degree of freedom system to the forcing function shown in fig.4. **[16]**

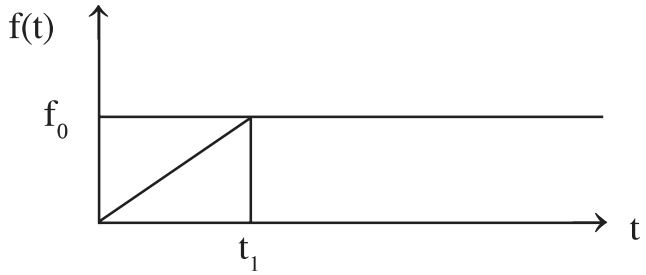

Fig.4

Q5) Explain following terms **[18]**

i) Centrifugal Pendulum

ii) Torsional vibration absorber.

SECTION - II

Q6) a) Explain working principal of sesmo meter and accelerometer. **[8]**

b) With a suitable example explain Experimental Modal Analysis. **[8]**

Q7) The motion of mechanical system with nonlinear restoring force is given by the equation $\ddot{x} + w_n^2 x + \beta x^3 = 0$ with initial conditions $x(0) = A$ and $\dot{x}(0) = 0$. Where w_n is the natural frequency of linear system.
Using Perturbation method show that $w^2 = w_n^2 + 3/4\ \beta A^2$ upto first order correction. **[16]**

Q8) a) Define and sketch 'Autocorrelation' function. How is it useful in random vibrational analysis. **[8]**

b) Two random processes are given as : **[8]**

i) $x = A\cos\omega t$

ii) $y = B\cos(\omega t + \phi)$

The phase angle between the two processes is a random variable having uniform probability between 0 to 2π. Calculate correlation between x & y.

Q9) a) Explain Octave band analysis of sound. **[6]**

b) Explain in brief the following terms.

i) Sound power level. **[4]**

ii) Sound pressure level

iii) Sound absorption coefficient

iv) Acoustic intensity

c) Define and explain sound power level and sound intensity. What is the sound pressure level of a sound source radiating energy at the rate of 0.6 W? **[6]**

Q10) Write the short notes of the following (any three) : **[18]**

a) Soft and Hard spring

b) Cross correlation function

c) Ambient emission noise standards in india

d) Wide band and narrow band process.

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