Total No. of Questions : 12]

SEAT No. :

P1522

[Total No. of Pages : 6

[4759] -32
B.E. (Mechanical/Mech. SW)
DYNAMICS OF MACHINERY
(2008 Course) (Semester -I) (402042)

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

Instructions to the candidates:

1) ***Answer 3 questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables slide rule and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain clearly the terms static and dynamic balancing. **[4]**

b) A shaft carries four masses A,B,C and D which are placed in parallel planes perpendicular to the longitudinal axis. The unbalanced masses at planes B and C are 3.6kg and 2.5kg respectively and both are assumed to be concentrated at a radius of 25mm while the masses in planes A and D are both at radius of 40mm. The angle between the planes B and C is 100^{o} and that between B and A is 190^{o}, both angles being measured in counter clockwise direction from the plane B. the planes containing A and B are 250mm apart and those containing B and C are 500mm. If the shaft is to be completely balanced, determine: **[12]**

i) Masses at the planes A and D

ii) The distance between the planes C and D

iii) The angular position of mass D

OR

Q2) a) What do you mean by balancing machine? Explain any one type of static balancing machine. **[6]**

P.T.O.

b) A three cylinder radial engine has axes at 120° to one another and their connecting rods are coupled to a single common crank. The stroke length is 100mm and length of each connecting rod is 150mm. If the mass of reciprocating parts per cylinder is 1 kg, determine the primary and secondary force of the engine running at 2400 rpm. **[10]**

Q3) a) With neat sketches explain underdamped, over damped and critically damped systems. **[3]**

b) A vibrating system is defined by the following parameters: **[5]**

m = 3 kg, k = 100 N/m, c = 3 N-s/m

Determine:

i) The damping factor

ii) The natural frequency of damped vibration

iii) Logarithmic decrement

iv) The ratio of two consecutive amplitudes

v) The number of cycles after which the original amplitude is reduced to 20%.

c) For the system shown in Fig. No. 01, find the equation of motion and also determine its natural frequency. **[8]**

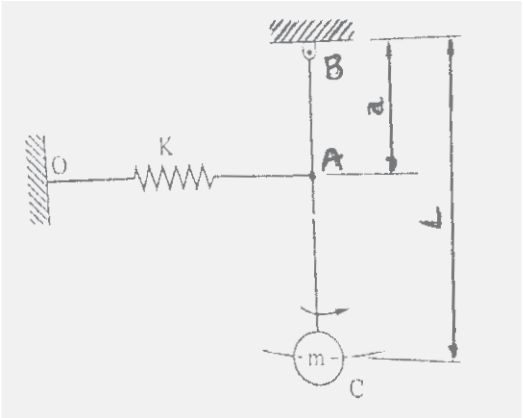

Fig no: 01

OR

Q4) a) What is logarithmic decrement? Derive an expression for the same. **[6]**

b) A homogeneous solid cylinder of mass 'm' is linked by a spring of constant 'k' N/m. If it rolls without slipping, show that frequency of oscillation is $\sqrt{\frac{2k}{3m}}$ rad/s **[5]**

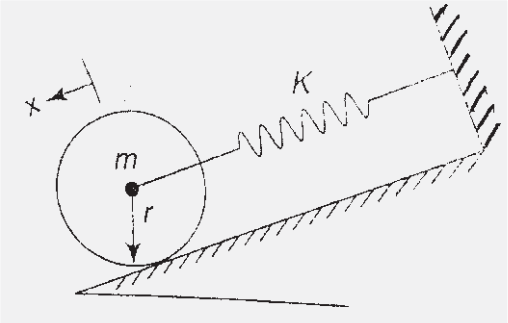

Fig no: 02

c) An under damped shock absorber is to be designed for an automobile. It is required that initial amplitude to be reduced to 1/16th in one cycle. The mass of the automobile is 200kg and damped period of vibration is 1 sec. Find necessary stiffness and damping constants of shock absorbers. **[5]**

Q5) a) The damped frequency of a system as obtained from a free vibration test is 10.5Hz. During the forced vibration test with constant excitation force on the same system, the peak frequency of vibration is found to be at 9.5Hz. Find the damping factor of the system and its natural frequency. **[4]**

b) Neatly plot the frequency response curves and draw any four conclusions from the same. **[6]**

c) A system having rotating unbalance has total mass of 25kg. The unbalanced mass of 1kg rotates with a radius 0.04m. It has been observed that at a speed of 1000rpm, the system and eccentric mass have a phase difference of 90^{o} and the corresponding amplitude is 0.015m. Find out: **[8]**

i) Natural frequency of the system

ii) Damping factor

iii) Amplitude at 1500 rpm

iv) Phase angle at 1500 rpm

OR

Q6) a) A vehicle has a mass 490kg and the total spring constant of its suspension system is 58,800 N/m. The profile of the road may be approximated to a sine wave of amplitude 40mm and wavelength 4m, as shown in fig no 03. Determine: **[9]**

i) Critical speed of the vehicle

ii) The amplitude of the steady state motion of the mass when the vehicle is driven at critical speed and $\xi = 0.5$.

iii) The amplitude of steady state motion of mass when the vehicle is driven at 57 km/hr and damping factor = 0.5.

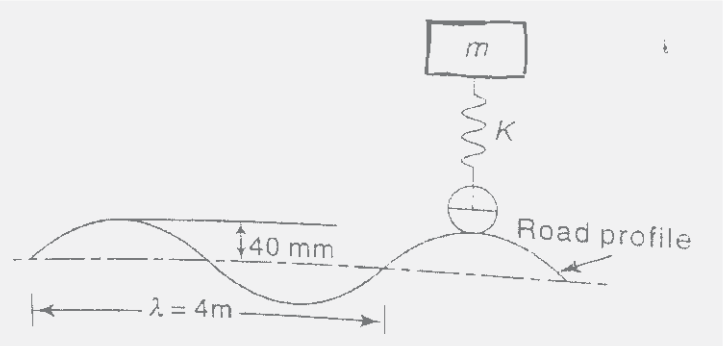

Fig no: 03

b) Explain the following terms. **[9]**

i) Vibration isolation

ii) Force transmissibility

iii) Motion transmissibility

SECTION - II

Q7) a) Explain the concept of torsionally equivalent shaft. **[6]**

b) Derive the differential equations of motion for the system shown in figure no.04. It is given that $m_1 = 20Kg$, $m_2 = 35Kg$ and $k = 3000N/m$. Determine **[12]**

i) The natural frequencies

ii) Amplitude ratio for the two mode

iii) Principal mode shape.

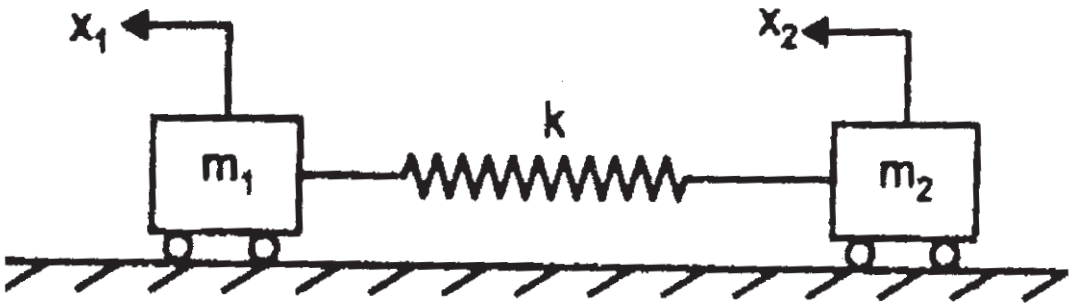

Figure No: 04

OR

Q8) a) What do you mean by whirling of shaft? Derive the expression for deflection vertical shaft with a single rotor without damping. **[6]**

b) Two equal masses of weight 400N each and radius of gyration 40cm are keyed to the opposite ends of shaft 60cm long. The shaft is 7.5cm diameter for the first 25cm of its length, 12.5cm diameter for the next 10cm and 8.5cm diameter for the remaining of its length as shown in figure no. 05. Find the natural frequency of the torsionally vibration of the system and position of node. Assume 0.84×10^{11} N/m^2. **[12]**

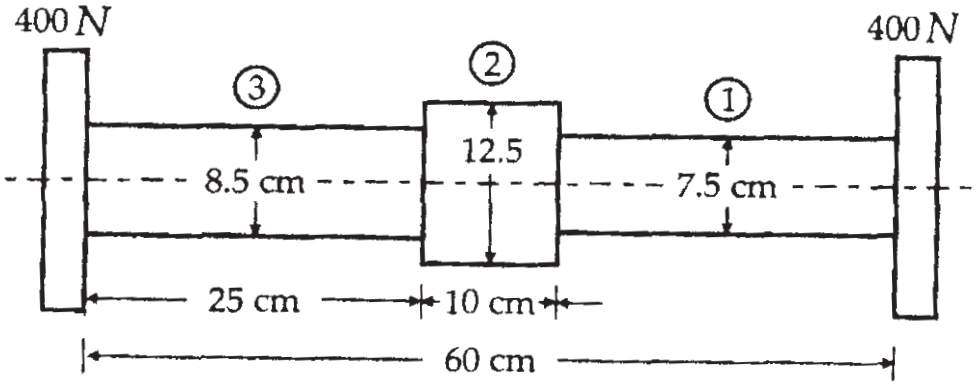

figure no:05

Q9) a) Explain human hearing mechanism with sketch. **[4]**

b) Explain the term sound reflection, Absorption, and Transmission. **[6]**

c) What do you understand by sound enclosure? Describe two types of sound enclosure. **[6]**

OR

Q10) a) Explain the working of microphone. **[4]**

b) Define sound field. Explain the various types of sound field in the vicinity of some sources. **[6]**

c) A mechanism working in machine shop is operating having there sound pressure levels as 95dB, 90dB, 92dB, 88dB and 83dB respectively. Determine total sound level when **[6]**

i) All mechanism are ON

ii) Machine 2 and 3 are turned OFF.

Q11) a) Explain general vibration measurement process with neat sketch. **[8]**

b) What do you understand by the time domain and frequency domain? How are they useful in predicting vibration failures? **[8]**

OR

Q12) Write short notes on the following.

a) Piezo electric accelerometer. **[5]**

b) Vibration exciter. **[6]**

c) FFT analyzer. **[5]**

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