Total No. of Questions : 12]

SEAT No. :

P732

[Total No. of Pages : 5

[4659] - 33

B.E. (Mechanical)

DYNAMICS OF MACHINERY

(Semester - I) (2008 Pattern)

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

Instructions to the candidates :

1) ***Answer three questions from each section.***
2) ***Answer 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) A four stroke five cylinder inline engine has a firing order 1- 4 - 5 - 3 - 2 - 1. The centre lines of cylinders are placed at equal interval of 150 mm. The reciprocating parts per cylinder have mass of 1.5 kg, the piston stroke is 100mm and the connecting rods are 175mm long. The engine rotates at 600 rpm. Discuss the primary and secondary balancing, values of maximum unbalanced couples about the central plane and the position of crank 1 from its inner dead centre position at which these values occurs. **[12]**

b) Explain the effect of Partial balancing of reciprocating parts of two cylinder locomotive. **[6]**

OR

Q2) a) Explain the method of direct and reverse crank to determine the unbalance forces in radial engines. **[6]**

b) Four masses are attached to the shaft a planes A,B, C and D at equal radii. The distance of planes B, C and D from A are 0.5m, 0.6m and 1.3m respectively. Masses at A, B and C are 60kg, 55kg and 80kg are respectively. If the system is in complete balance, determine the mass at D and the position of masses B, C and D with respect to 'A'. **[12]**

P.T.O.

Q3) a) For the mathematical model shown in Fig. 1, determine the equivalent stiffness. **[8]**

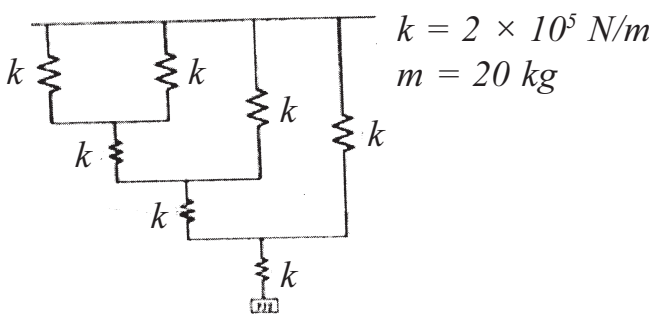

Fig.1.

b) Derive that the loss of amplitude per cycle for coloumb damping is given by 4 F/K. Where is a frictional force and K is spring stiffness. **[8]**

OR

Q4) a) What is logarithmic decrement? Derive the equation for it? **[8]**

b) In single degree damped vibrating system, a suspended mass 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. **[8]**

Determine the

i) Stiffness of the spring,

ii) Logarithmic decrement,

iii) Damping factor, and

iv) Damping coefficient

Q5) a) Explain forced vibration with rotating unbalance. **[6]**

b) The vibrating system is displayed for vibration characteristics. The total mass of the system is 30 kg. At the speed of 900rpm, system and eccentric mass have phase difference of 90^{o} and corresponding amplitude is 18mm. The eccentric unbalance mass of 1.2 kg. has radius of rotation 45mm. Determine: **[10]**

i) natural frequency

ii) damping factor, ξ

iii) amplitude at 1550 rpm

iv) phase angle at 1550 rpm.

OR

Q6) a) Explain transmissibility and frequency ratio for different damping factors. **[6]**

b) Define quality factor and state its significance in frequency response curve. **[4]**

c) The static deflection of an automobile on its spring is 10cm under. Find the critical speed when the trailer is traveling over a road with a profile approximated by a sine wave of amplitude 8cm and wavelength of 16m. Assume damping to be given by $\xi = 0.05$. What will be the amplitude of vibration at 75 km/hr? **[6]**

SECTION - II

Q7) a) Two equal masses of weight 400 N each and radius of gyration 400 mm are keyed to the opposite ends of a shaft 600 mm long. The shaft is 75 mm diameter for the first 250 mm of its length, 125 mm diameter for the next 100 mm and 85 mm diameter for the remaining of its length. Find the frequency of free torsional vibrations of the system and position of node. Assume $G = 0.84 \times 10^{11}$ N/m^2. **[8]**

b)` A disc made of solid steel with a diameter of 120 mm and thickness of 20 mm is fixed in the center of a 0.5 m shaft having 12.5 mm diameter. The shaft may be considered to be simply supported at the two extreme ends. The bearings have equal flexibility in all the directions and the equivalent spring constant for each bearing is 20,000 N/m. Find the whirling speed of the shaft. Assume density of disc material as 8000 kg/m^3. **[8]**

OR

Q8) Set up the differential equations of motion for an automobile having the following data and determine the two natural frequencies and principal modes of vibrations of the automobile : **[16]**

Weight of automobile = 2000 N;

Radius of gyration about its CG = 1.1 m

Wheel base = 3 m

Distance between front axle & CG = 1.4 m;

Combined stiffness of front springs =6×10^6 N/m;

Combined stiffness of rare springs =6.5×10^6 N/m

Q9) a)` Explain the working of human hearing mechanism with neat diagram. **[6]**

b) The sound pressure level is 90 dB at a distance 5 m from a point source. Assuming a free progressive spherical wave and standard atmospheric conditions, determine sound power level of the source. **[4]**

c) The sound pressure level measured for machines 1,2 and 3 are 86 dB, 88 dB and 85 dB respectively, when operating independently in the presence of background noise. When the machines are turned off, the sound pressure level at the same point is 84 dB. Determine the overall sound power level of 3 machines independent of background noise. **[6]**

OR

Q10)a) Explain the working of sound level meter with neat diagram. **[6]**

b) An operator in machine shop are operating 5 machines having their sound pressure levels at the position being 95, 90, 92, 88 and 83 dB respectively. Determine the total sound pressure level when **[6]**

i) All 5 machines are turned on.

ii) When machine 1 is turned off.

iii) When machines 2 and 3 are turned off.

c) Define following terms : **[4]**

i) Decibel Scale

ii) Acoustic Impedance

iii) Reverberation time

iv) Absorption coefficient

Q11)a) What is FFT? With the help of block diagram, explain the working of FFT analyzer. State the applications of FFT analyzer with reference to vibration & noise. **[6]**

b) What do you mean by vibration absorber? Explain undamped dynamic vibration absorber? **[6]**

c) The static deflection of the vibrometer mass is 20 mm. The instrument when attached to a machine vibration with a frequency of 125 cpm records relative amplitude of 0.03 cm. Find out for the machine, **[6]**

i) the amplitude of vibration

ii) the maximum velocity of vibration and

iii) the maximum acceleration.

OR

Q12)a) Explain following vibration Exciters : **[6]**

i) Mechanical Exciter

ii) Electrodynamics Exciter

b) What do you mean by vibration isolation? Explain any 4 isolating materials along with their industrial applications. **[6]**

c) An accelerometer having natural frequency of 1000 cpm and a damping factor of 0.7 is attached to a vibrating system. Determine the maximum acceleration of the system when the recorded amplitude is $\omega^2 . Z = 0.5$ m/s^2, when the system performs a harmonic motion at 400 cpm. **[6]**