Total No. of Questions : 12]

SEAT No. :

P1693

[Total No. of Pages :5

[4859]-33
B.E.(Mechanical/Mech.S/W)
DYNAMICS OF MACHINERY
(2008Pattern) (Semester-I)

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) Explain partial balancing of reciprocating engine. **[6]**

b) The firing order of a six cylinder vertical four stroke inline engine is 1-4-2-6-3-5. The piston stoke is 80mm and the length of each connecting rod is 180 mm . The pitch distances between the cylinder centre lines are 80 mm, 80 mm, 120 mm, 80 mm and 80mm respectively. The reciprocating mass per cylinder is 1.2 kg and the engine speed is 2400 rpm. Determine the out of balance primary and secondary froces and couples on the engine taking a plane midway between the cylinder 3 and 4 as the reference plane. **[12]**

OR

Q2) a) Explain the direct and reverse crank method for determining unbalanced forces in radial engines. **[6]**

b) The following data refers to a 90° two cylinder V-engine.

Mass of reciprocating part per cylinder =3 kg.

Lenght of crank = 100 mm

Length of connecting rod = 400 mm

Speed of engine = 2000 r.p.m.

Examine the engine for primary and secondary balancing, when the crank bisects the lines of cylinders.(Use direct and reverse crank method).**[12]**

P.T.O.

Q3) a) For the system shown in fig.1 if K_1=2400N/m K_2=2400 N/m K_3-2400N/m and K_4=K_5=500 N/m Find 'm' such that the system has a natural frequency 10 Hz. **[8]**

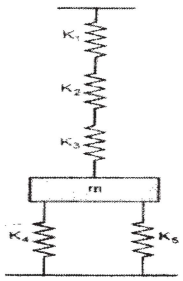

fig.1

b) A mass of 1 kg is supported on a spring of 9800 N/m and has a dashpot having damping coefficient of 6 N-sec/m. Find the damped natural frequency. Also find the logarithmic decrement and amplitude after 4 cycles, if the initial displacement is 5mm. **[8]**

OR

Q4) a) A door along with door closing system shown in fig. 2has a moment of inertia of 25 kg-m^2 about the hinge axis. If the stiffness of torsional spring is 20 N-m/ rad, find the most suitable value of the damping coefficient. **[8]**

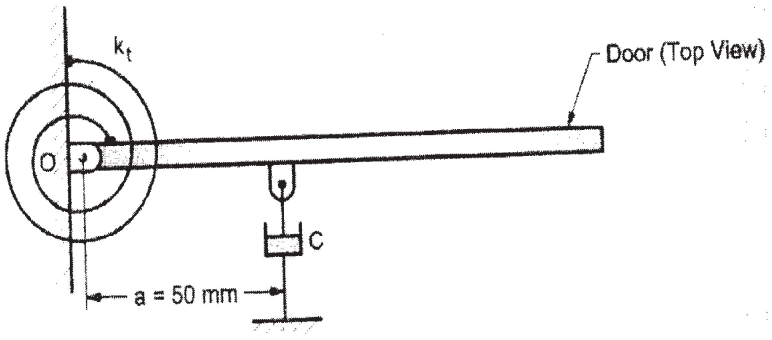

Fig.2

b) A mass of 500 kg is suspended with a spring. The system vibrates with a natural frequency of 3 rad/sec. If the initial amplitude is 24 mm and subsequent half amplitudes are 20 and 16 mm, determine the stiffness of spring and coulomb damping force. Also find the number of cycles corresponding to 50% reduction of its initial amplitude. **[8]**

Q5) a) Write short note on : **[8]**

i) Forced vibration due to rotating unbalance.

ii) Forced vibration due to reciprocating unbalance.

b) The body of a 600 kg vehicle is connected to the wheels through a suspension system that is modeled as a spring of stiffness 5×10^5 N/m parallel with a viscous damper of damping coefficient 3000Ns/m. The wheels are assumed to be rigid and follow the road contour which is approximated as a sine wave of amplitude 0.01 meter and a wavelength of 20 meters. If the vehicle travels at a constant speed of 60 Km/hr, what is the amplitude of the vehicle? What is the critical speed of the vehicle? **[8]**

OR

Q6) a) What are frequency response curves? State any four observations from these curves under different damping condition? **[8]**

b) A centrifugal fan weighs400N and has a rotating unbalance of 250 N-cm. The damper used has a damping factor of 0.2. Specify the stiffness of the spring used for mounting such that only 10% of the unbalanced force is transmitted to the floor. The fan is running at a constant speed of 800 r.p.m. **[8]**

SECTION-II

Q7) a) Explain the following term **[6]**

i) Mode Shapes.

ii) Zero frequency.

iii) Node point.

b) A shaft shown in fig. 3 carries two rotors A and B. The mass of rotor A is 300 kg with radius of gyration of 0.75 m, while the mass of rotor B is 500 kg with radius of gyration of 0.9 m

i) Find the natural frequency of torsional vibration.

ii) It is desired to have the node at mid section of the shaft of diameter 120 mm by changing the diameter of the portion of shaft having 90 mm diameter. What would be the new diameter? Assume $G=84\times10^9$ N/m^2. **[12]**

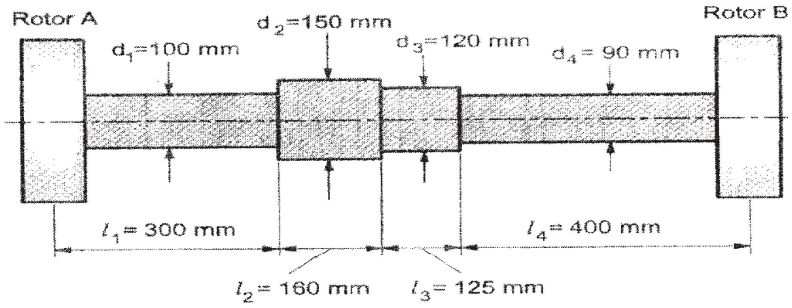

Fig 3.

OR

Q8) a) Derive an expression for the total length of an equivalent shaft for geared system, neglecting inertia of gears? **[6]**

b) A vertical shaft of 12 mm diameter rotates in sleeve bearings and a disc of mass 15 kg is mounted on the shaft at mid span. The distance between two bearings is 0.5 m. If the C.G. of rotor is 0.8 mm from the axis of the shaft, determine:

i) The critical speed of rotation of the shaft: and

ii) the speed range in which the bending stress in shaft will exceed 125 N/mm^2 Assume $E=2\times10^5$ N/mm^2. **[12]**

Q9) a) Noise at the construction site is contributed by a few construction activities such as :

Piling work:104 dB, Scraper:93dB, Bulldozer:94dB, Mobile compressor:73 dB and Mechanical shovel:76dB on A-weighting networks. What is the overall sound pressure level. **[6]**

b) The sound pressure level measured at 10 m from an automobile horn is 110 dB. Determine the sound pressure level at distance of i) 20 m ii) 80 m . Assume that the inverse square law holds good between intensity and distance. **[4]**

c) Explain the working of condenser microphone. **[6]**

OR

Q10)a) Show that when the distance from point source is doubles the sound intensity level decreases by 6 dB. **[6]**

b) The sound pressure level measured at a machine floor with a noisy machine operating nearby is 89.0 dB. When machine is turned off, the sound pressure level measured at the same location is 81.0 dB. What is sound pressure level due to machine only. **[4]**

c) Explain any one type of sound enclosure. **[6]**

Q11)a) In a seismic instrument if mass, m is 0.1 kg, stiffness of spring, K is 1 N/mm and damping ratio, ξ is 0.5, Determine the amplitude of recorded motion if the motion of vibrating body is 3 sin 200t (mm). **[4]**

b) What do you mean by seismometer? Explain with the help of response curve of vibration measuring instrument how the relative amplitude recorded on dial become equal to the amplitude of Vibrating body? **[8]**

c) Explain the working of stroboscope. **[4]**

OR

Q12)a) A fullarton tachometer is used to measure the frequency of vibration system. A mass of 0.02 kg is attached at the end of the reed so that its resonance is at a frequency of 50 Hz. The reed is of 50 mm long and 5 mm wide. Determine the thickness of reed. Take modulus of elasticity for reed material as 200×10^9 N/m^2. **[4]**

b) What do you mean by condition monitoring of machines? Explain any three method of condition monitoring technique? **[8]**

c) Explain passive Vibration isolation technique. **[4]**

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