Total No. of Questions :10]

SEAT No. :

P3671

[Total No. of Pages :4

[4959]-1033
B.E. (Mechanical)
Dynamics of Machinery
(2012 Course) (End Sem) [402043]

Time : 2 1/2 Hours *[Max. Marks :70]*

Instructions to the candidates:

1) ***Solve Q1 or Q2 Q3 or Q4 Q5 or Q6 Q7 or Q8 Q9 or Q10.***
2) ***Draw Neat diagrams wherever necessary.***
4) ***Use of scientific calculator is allowed.***
5) ***Assume suitable data wherever necessary.***
6) ***Figures to the right indicate full marks.***

Q1) a) Why single cylinder engines cannot be balanced completely? **[4]**

b) A 3 cylinder radial engine has cylinders located 120° from each other. Reciprocating mass of each cylinder is 1.2 kg. Length of crank is 75 mm and each connecting rod is 250 mm long. Find out maximum primary and secondary unbalance forces, if the engine runs at 2500 rpm. **[6]**

OR

Q2) a) Explain with displacement-time plot, the overdamped, critically damped and underdamped vibratory systems. Give suitable examples **[4]**

b) A spring mass system has spring stiffness "k" N/m and a mass of "m" kg it has natural frequency of vibration as 12 Hz. An extra 2 kg mass is coupled to "m" and the natural frequency reduces by 2Hz Find the values of k and m. **[6]**

Q3) a) Define the following terms related to vibrations: **[4]**

i) Logarithmic decrement.

ii) Damping coefficient.

iii) Damping factor.

iv) Critical damping coefficient.

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b) A horizontal spring mass system with Coulomb damping has a mass of 5.0 kg attached to a spring of stiffness 980 N/m. If the coefficient of friction is 0.025, calculate. **[6]**

i) The number of cycles corresponding to 50% reduction in amplitude, if the initial amplitude is 50 mm.

ii) The time taken to achieve this 50% reduction.

OR

Q4) a) Explain frequency response curve with neat diagram. **[4]**

b) Derive an expression for magnification factor for steady state amplitude of vibration subjected to external excitation $F_{\circ} \sin \omega t$. **[6]**

Q5) a) Explain with neat diagram mathematical model of a motorbike **[4]**

b) Two subway cars as shown in following Fig. 1, have 2000 kg mass each and are connected by a coupler. The coupler can be modeled as a spring of stiffness k = 280 kN/m. Write down the equations of motion and determine the natural frequencies and mode shapes. **[12]**

Fig. 1

OR

Q6) a) Explain the concept of torsionally equivalent shaft and derive the equation for its equivalent length. **[4]**

b) The flywheel of an engine driving a dynamo has mass of 200 kg and has a radius of gyration of 300 mm. The shaft at the flywheel end has an effective length of 250 mm and is 50 mm Diameter the ar mature mass is 225 kg and has a radius of gyration of 255 mm. The dynamo shaft has a diameter of 43.75 mm and a length of 200 mm. Neglecting the inertia of the shaft and coupling calculate the frequency of the torsional vibrations and position of node. Take the modulus of rigidity for shaft material as 80 GPa. **[12]**

Q7) a) Explain the following terms: **[4]**

i) Vibration isolation.

ii) Force transmissibility.

b) What are the various methods of vibration control? **[6]**

c) A machine of one tonne is acted upon by an external force of 2450 N at a frequency of 1500 rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2 mm under the machine load and an estimated damping ζ =0.2 are used. Determine. **[8]**

i) The force transmitted to the foundation.

ii) The amplitude of vibration of machine.

iii) The phase lag.

OR

Q8) a) Explain with neat diagram the working principle of seismic instrument. **[4]**

b) Explain the ISO standards for vibration measurement. **[6]**

c) An instrument of 50 kg mass is located in an airplane cabin which vibrates at 2000 cpm with an amplitude of 0.1 mm. Determine the stiffness of the four steel springs required as supports for the instrument to reduce its amplitude to 0.005 mm. Also calculate the maximum total load for which each spring must be designed. **[8]**

Q9) a) Explain the working of a microphone. **[4]**

b) Explain the various methods of industrial noise control **[6]**

c) When operating independently in the presence of background noise measurement at a given location of the sound pressure level for machines 1,2 and 3 are respectively 88 dB, 90 dB and 87 dB. When the machines are turned off, the sound pressure level at the same point is 86 dB. Determine the overall sound pressure level of the3 machines independent of the background noise **[6]**

OR

Q10)a) Explain anechoic chamber and reverberant chamber **[4]**

b) Derive a relation between sound intensity level and sound pressure level. **[6]**

c) A home theatre installation has 5 full range speakers. The 3 front ones are each capable of producing a sound pressure level of 90 dB at the listening position. The 2 rear ones are each capable of producing a sound pressure level of 85 dB at the listening position. What is the total sound pressure level that the whole installation of 5 speakers is capable of producing at the listening position? **[6]**