6E3052

Roll No. _____ Total No. of Pages : 4

6E3052

B.Tech VI Sem. (Back) Exam. April- May 2012

Mechanical Engg.

6M E4 Noise , Vibration and Harshness

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five questions,** selecting one question from **each unit.***
*All Question carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*
Units of quantities used/ calculated must be stated clerly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. **Nil** 2. **Nil**

UNIT - I

1. (a) In the presence of back ground noise of 85dB level ,the sound measure ments of the operation of three machine independently provided values as 88 dB , 90 dB , 92 db Determine the overall SPL and average sound pressure level of the three machine working together in the absence of back ground noise 8

(b) Explain the following terms in detail

(i) Loudness

(ii) Sound spectra and octave band analysis. 8

Or

1 (a) Explain the noise control methods at the source level and along the path. 8

(b) Write a detailed note on noise standards and limits. 8

Unit -II

2. (a) An automobile is found to have a natural frequency of 20rad /sec with out passengers and 17.32 rad /sec with passengers of mass 500 kg. Find the mass and stiffness of the automobile by treating it as a single degree of freedom system 8

(b) A stepped shaft has three segments of diameters and lengths as follows: d_1 = 40mm, L_1 =0.3m, d_2 =50 mm, L_2 =0.4m, d_3=80 mm and L_3 =0.5 m, Find the equivalent length of the shaft of uniform diameter of 50 mm, Hence, find the natural frequency of torsional vibration if G =0.8 X 10^{11} N/m^2 and man moment of inertia of the rotor is 12 kg m^2. 8

Or

2. (a) Compare the vibration behavior of a viscously damped system with hysteretically damped system and obtain the excretions for the complex stiffness of the system and response of a hysteretically damped system. 8

(b) A mass of 20 kg slides back and forth on a dry surface due to the action of a spring having a stiffens of 10 N / mm. After four complete cycles the amplitude has been found to be 100 mm. What is the average coefficient of friction between the two surfaces if the original amplitude was 150 mm? How much time has elapsed during the four cycles? 8

Unit - III

3 (a) Derive the expression for the response of a spring –mass – damper system subjected to harmonic excitation of base . plot the response curves for different amount of damping against the frequency ratio.

(b) A single cylinder vertical petrol engine of total mass 300 kg is mounted upon a steel chassis and causes a vertical static deflection of 3 mm. the receprocating parts of the engine have a mass of 21kg and move through a vertical stroke of 130 mm with simple harmonic motion. A dashpot attached to the system offers a resistance of 480 N at a velocity of 0.3 m/ sec. Determine.

(i) The speed of the driving shaft at resonance and

(ii) The amplitude of steady state vibration when the driving shaft of the engine rotates at 450 rpm. 8

Or

3. (a) An automobile trailer mover over the road surface which has approximately sinusoidal profile with a wavelength of 8metres and amplitude of 6 cm. The trailer is pulled on the rode surface with a velocity of 60 km/ Hr. Calculate the critical speed of trailer if the vibration amplitude is 1.5 cm for the trailer mass of 50 kg . 8

(b) A vibrating system having mass 2 kg is suspended by a spring of Stiffness 1200 N /m and is put to harmonic excitation of 12N. Assuming viscous damping, Determine.

(i) The resonant frequency

(ii) The phase angle

(iii) The amplitude at resonance

(iv) The frequency corresponding to the peak amplitude

Take C= 40 N-S /m . 8

Unit - IV

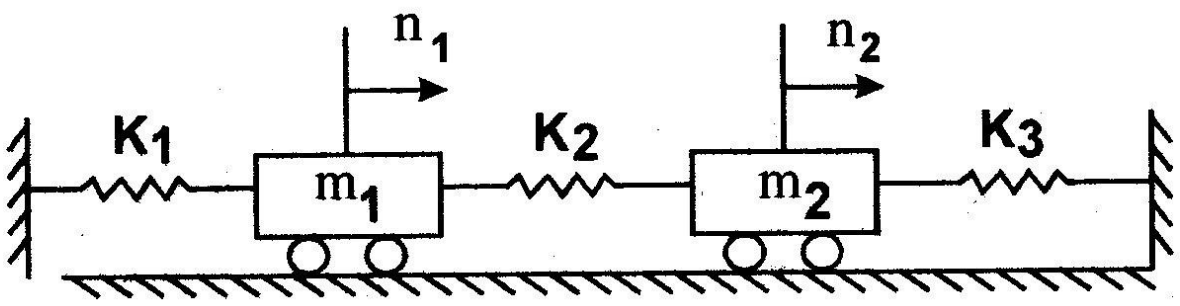
4. (a) With the help of an example illustrates the use of influence coefficients and man well's reciprocal theorem in finding natural frequency of a system 8

(b) Explain the principle and working of centrifugal pendulum absorber . 8

Or

4. Find the natural frequencies and mode shapes of the system shown in figure.

Take $m_1 = 1.2$ kg, $m_2 = 0.6$ kg, $K_1 = K_2 = K_3 = 25$ N/m.



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Unit - V

5. Derive governing equation for the torsional vibration of a shaft fined at both end. Find the frequency equation and mode shapes for the same. 16

Or

5 (a) Write a short note on Hozer's method 8

(b) Find the lowest natural frequency of the system shown in figure using Rayleigh's method.

Take the value of modulus of elasticity $E = 2 \times 10^{11}$ N /m^2 and

$I = 3 \times 10^{-7} M^4$ 8