CBCS SCHEME

USN | | | | | | | | | |

18MR71

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
Mechanical Vibrations

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain : i) Types of vibration   ii) Beats Phenomenon   **(10 Marks)**
   b. Add the following harmonics motions and check the solution Graphically.
      $x_1 = 3\sin(\omega t + 30°)$, $x_2 = 4\cos(\omega t + 10°)$ **(10 Marks)**

OR

2 a. Explain the following :
      i)   Forced vibration
      ii) Damped vibration
      iii) Simple Harmonic Motion
      iv) Degree of Freedom.   **(08 Marks)**
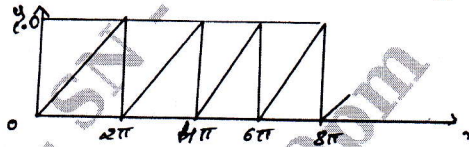   b. Find the Fourier series for the saw tooth wave as shown in Fig Q2(b)

Fig Q2(b)   **(12 Marks)**

Module-2

3 a. Derive equation of motion and natural frequency of vibration of a spring mass system of by
      energy method.   **(08 Marks)**
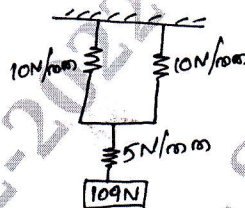   b. Determine the natural frequency of the system shown in Fig Q3(b)-i) and Fig Q3(b)-ii)
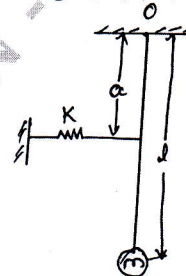

Fig Q3(b)-i)   Fig Q3(b)-ii)   **(12 Marks)**

OR

4 a. Set up the differential equation for a viscous damping system and obtain the complete
      solution for critically damped system.   **(12 Marks)**
   b. A spring mass damped system shown in Fig Q4(b) determine :   i) Natural frequency
      ii) Damping factor   iii) Frequency of Damped vibration   iv) Logarithmic Decrement.
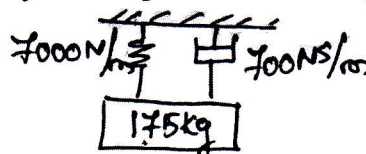

Fig Q4(b)   **(08 Marks)**

Module-3

5   a. What is Transmissibility? Explain its significance. **(10 Marks)**
    b. A Machine of Total mass 17kg is mounted on springs having stiffness K = 11.000N/cm. A piston within the machine has a mass of 2kg has a reciprocating motion with stroke 7.5cm and speed 6000rpm. Assuming the motion to be SHM. Determine : i) Amplitude of Machine ii) Transmissibility iii) Force-transmitted to the Ground. Take $\xi = 0.2$ **(10 Marks)**

OR

6   a. Explain with neat sketch i) Vibrometer ii) Frahm Tachometer. **(10 Marks)**
    b. A rotor of mass 12kg is mounted midway on a 25mm diameter horizontal shaft supported at the ends of two bearing. The spas between the bearings is 900mm. Because of some manufacturing defect. The C_g of the rotor is 0.02mm away from geometric centre of rotor. If the system rotates at 3000rpm, determine the amplified of steady state vibrations and dynamic force on the bearing. Take E = 200GPa. **(10 Marks)**

Module-4

7   a. A shaft 180mm diameter is supported in two bearing 2.5m apart. It carries 3 discs of weight 2500N, 5000N and 2000N at 0.6m, 1.5m and 2m form the left end. Assume the shaft weight to be 1900N/m length. Determine the natural frequency of transverse vibration by Dunkerley's method. **(10 Marks)**
    b. Find the lowest natural frequency of vibration for the system shown in Fig Q7(b) by Rayleigh's method. $E = 1.96 \times 10^{11} N/m^2$, $I = 4\times10^{-7}m^4$.

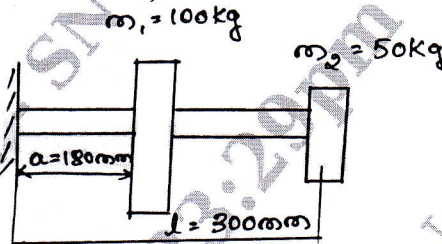Fig Q7(b) **(10 Marks)**

OR

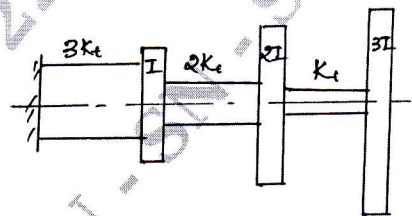8   Using Stodola's method, determine the lowest natural frequency of the torsional system shown in Fig Q8.

Fig Q8 **(20 Marks)**

Module-5

9   a. Write a short note on Dynamic testing machines and structures. **(10 Marks)**
    b. Explain the following: i) Microphones   ii) Sound level meters. **(10 Marks)**

OR

10 a. Sketch and explain the arrangement for experimental model analysis. **(10 Marks)**
    b. Explain the various techniques for machine condition monitoring. **(10 Marks)**

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