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BIMEE-008

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

00682

December, 2017

BIMEE-008 : MECHANICAL VIBRATION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) What is Vibration ? What are the main causes of vibration ? How do you eliminate undesirable vibrations ? 7

(b) What is Degree of Freedom ? Classify the various types of degrees of freedom with suitable sketches. 7

2. (a) Name the methods of measuring vibration. 2

(b) A force $p_0 \sin \omega t$ acts on a displacement $x_0 \sin (\omega t - \pi/3)$, if

$p_0 = 100$ N

$x_0 = 0{\cdot}02$ m

$\omega = 2\pi$ rad/sec.

Find the work done during (i) the first cycle, (ii) the first second, and (iii) the first quarter second. *12*

3. (a) Derive a differential equation for a spring-mass system under undamped free vibration. *7*

(b) An unknown mass m is attached to one end of a spring of stiffness k having a natural frequency of 6 Hz. When 1 kg mass is added with m, the natural frequency of the system is lowered by 20%. Determine the values of the unknown mass m and stiffness k. *7*

4. (a) What are the different types of damping ? Explain free vibrations with viscous damping with suitable sketches. *7*

(b) Describe the forced vibration with rotating and reciprocating unbalance with suitable sketches. *7*

5. (a) Explain vibration isolation and transmissibility in forced vibration with the help of suitable sketches. 7

(b) A 1000 kg machine is mounted on four identical springs of total spring constant k and having negligible damping. The machine is subjected to a harmonic external force of amplitude F_0 = 490 N and frequency 180 rpm. Determine the amplitude of motion of the machine and maximum force transmitted to the foundation because of the unbalanced force when $k = 1{\cdot}96 \times 10^6$ N/m. 7

6. (a) Explain dry friction damper with a neat sketch. 7

(b) Determine the natural frequency of torsional vibrations of a shaft with two circular discs of uniform thickness at the ends. The masses of the discs are M_1 = 500 kg and M_2 = 1000 kg, and their outer diameters are D_1 = 125 cm and D_2 = 190 cm. The length of the shaft is l = 300 cm and its diameter d = 10 cm. Modulus of rigidity for the material of the shaft is $\sigma = 0{\cdot}83 \times 10^{11}$ N/m^2. 7

7. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Torsional Vibrations

(b) Logarithmic Decrement

(c) Support Excitation

(d) Centrifugal Pendulum Absorbers

(e) Influence Coefficients

(f) Critical Speed of Shafts