Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Marine Engg.) (2013 Batch) (Sem.–7)

MECHANICAL VIBRATIONS

Subject Code : BTME-803

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

Q1. Answer briefly :

a) Define the terms “Critical Damping” and “Damping Ratio”.

b) State the working principle of a Vibrometer.

c) Why is it important to find the natural frequency of a vibrating system?

d) What are principal co-ordinates?

e) State the differences between discrete system and continuous system.

f) What happened to the response of an undamped system at resonance?

g) Explain the various elementary parts of a vibrating system.

h) Give the orthogonality principle for a system with three degree of freedom.

i) Explain Rayleigh's method for determining natural frequency of the system.

j) What is the critical speed of a shaft?

SECTION-B

Q2. Explain in detail the working of a centrifugal pendulum vibration absorber.

Q3. Derive suitable expression for longitudinal vibrations for a rectangular uniform cross-section bar of length *l* fixed at one end and free at the other end.

Q4. A vibrating system in a vehicle is to be designed with the following parameters :

$$K = 100\ N/m,\ C = 2\ N\text{-}sec/m,\ m = 1\ Kg$$

Calculate :

(a) The decrease of amplitude from its starting value after complete oscillations.

(b) The frequency of oscillation

Q5. Calculate the natural frequency of a shaft of diameter 10 cm and length 300 cm carrying two discs of diameters 125 cm and 200 cm respectively at its ends and weighing 480 Kg and 900 Kg respectively. Modulus of rigidity of the shaft may be taken as 2×10^6 Kgf/cm^2.

Q6. Add the following vectors analytically :

$X_1 = 4\cos(\omega t + 10°)$ $X_2 = 6\sin(\omega t + 60°)$

Check the solution graphically.

SECTION-C

Q7. 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 r.p.m. Determine

(a) The amplitude of motion of the machine and maximum force transmitted to foundation because of the unbalanced force when $k = 1.96 \times 10^6$ N/m.

(b) The same as in (a) for the case when $k = 9.8 \times 10^4$ N/m.

Q8. Find the lower natural frequency of vibration for the system shown in Fig. by Rayleigh's method. Assume : $E = 1.96 \times 10^{11}$ N/m^2, $I = 4.0 \times 10^{-7}$ m^4

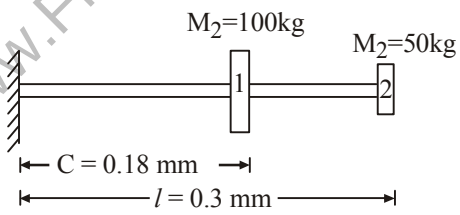

Fig.

Q9. Write a short note on the following :

(a) Derivation of logarithmic decrement

(b) Euler's equation of motion for beam vibration

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.