INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
End Semester Examinations December 2018
M.Tech. (Marine Engineering and Management)
Semester-I
Ship Vibration (RS23T0006)

Date: 29-12-2018 Maximum Marks : 100
Time: 3 Hrs Pass Marks : 50

Answer any five questions. All questions carry equal marks.
(5x20=100 Marks)

1 a) Derive the equation of Logarithmic decrement and also determine Logarithmic decrement if damping factor (ζ) is very small.

b) The measurements on a mechanical vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/mm. If the vibrating system has a dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s; find i) critical damping coefficient ii) damping factor iii) logarithmic decrement and iv) ratio of two consecutive amplitudes.

(8 +12)

2.a)How do you measure the vibration ? Explain the function of Seismic Instrument and Frahm's Reed Tachometer.

b) Determine natural frequency of undamped free vibration by
(i) Equilibrium method,
(ii) Energy method,
(iii) Reyleigh's method. (8+12)

3.a) Why is whirling of shaft occurred?

b) A rotor of mass 10 kg is mounted midway on a 20 mm diameter horizontal shaft supported at the ends by two bearings. The bearing span is 0.8m. Because of certain manufacturing defect, the centre of gravity of disc is 0.1 mm away from the geometric centre of the rotor. If the system is rotates at 3000 rpm, determine the amplitude of steady state vibration and the dynamic force transmitted to the bearing. Take $E = 2 \times 10^6$ bar.

(4+16)

4. a) Find fundamental frequency by Dunkerleys method for simply supported beam carrying multiple concentrated loads.

b) Use Dunkerley's method to find fundamental natural frequency of transverse vibration for the system of cantilever shaft (mass negligible) of 30 cm length carrying mass of m_1 =100 kg and m_2 =50 kg from fixed end at a distance of 18 cm and 30 cm respectively. Assume $E = 1.96 \times 10^{11} \frac{N}{m^2}$ and $I = 4.0 \times 10^{-7}$ m4. (8+ 12)

5 a) Explain the concept of added mass and its effect in ship hull vibration.

b) A ship of length 134 m, breadth 19.7 m and draught 7.58 m has a displacement of 15600 tonnes. The second area moment (I) is 364000 m².cm². Determine the natural frequency of vibration allowing for entrained water. The constant can be taken as 24000. (8+12)

6. Write short note (Any four):

i) Vibration Isolation

ii) Quality Factor, Bandwidth

iii) Explain Direct influence coefficients and cross influence coefficients

iv) Explain Generalized coordinates and Principal coordinates

v) Group velocity of wave trains

(5x4=20)

7.a) Explain the 'Trochoidal theory' with trochoidal curve for deep sea waves.

b)Explain the effects of ship motion due to slamming, Deck wetness, ship routing, wave making resistance force.

(10+10)

8) Explain various (a) Active Stabilization and (b) Passive Stabilization systems used to control ship motions. (10+10)

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