# INDIAN MARITIME UNIVERSITY
**(A Central University, Government of India)**

December 2017 End Semester Examinations
M. Tech (Marine Engineering & Management)
First Semester

**Ship Vibration**

**Subject Code**: PG13T1104
**Time:** 3 Hrs
**Date:** 07.12.2017

**Maximum Marks:** 100
**Pass Marks:** 50

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

**1** a) Explain the terms along with displacement vs time plot of each (i) Under-damping, (ii) Critical damping, (iii) Over-damping.

b) The ratio of successive amplitude of a viscously damped single degree of freedom system is found to be 20 to 1. Determine (i) damping of above (ii) the ratio of successive amplitudes if the amount of damping is double (iii) the ratio of successive amplitudes if the amount of damping is halved.

(Marks 10+10)

**2** a) Define whirling. Why it occurs?

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. (Marks 6+14)

**3.** Write short note (Any four):
i) Quality factor and Bandwidth ii) Equivalent damping
iii) Vibration Isolation & Transmissibility (iv) Group velocity of wave trains
(v) Fundamental natural frequency.

(Marks 5x4=20)

**4**.a) Explain Dunkerleys method to find fundamental frequency for simply supported beam carrying multiple concentrated loads.

b) A simply supported beam of length L and of uniform cross section having mass 'm' per unit length. The deflection curve is assume to be a sine curve, $y = Y\sin\left(\frac{\pi x}{L}\right)$ where Y is maximum deflection at mid span. Find the natural frequency by Rayleigh's method.

(Marks 10+10)

**5**.a)For the torsional vibration of a two-rotor system, where the shaft with two discs at both ends is supported by frictionless bearings, determine

i) the natural frequencies
ii) the corresponding principal modes
iii) Location of node

b) Explain the terms –Generalized co-ordinate and principle co-ordinate?

(Marks 14+ 6)

**6.** a) How do you classify the type of sea waves based on motion of waves in water?
b) Explain the various effects of ship motion in waves
c) Explain the concept of added mass and its effect in ship hull vibration.

(Marks 4+10 +6)

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

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 $m^2.cm^2$. Determine the natural frequency of vibration allowing for entrained water. The constant can be taken as 24000.

(Marks 10+10)

**8)** Why stabilization system is required in ship? What are the types of stabilization systems? Describe the various stabilization systems in details?

(Marks 4+4+12)

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