Indian Maritime University
(A Central University, Govt. Of India)
End Semester Examination Dec-2019/Jan-2020
B. Tech(Marine Engineering)
Semester -IV
Mechanics of Machines II
(UG11T3403)

Date:04-01-2020	Max Marks:**70**
Time:3 Hrs	Pass Marks: **35**

Part – A (compulsory)
Answer the following (10x2=20 Marks)

1. Define torsionally equivalent system
2. Which two conditions are used to locate the position of node in a two rotor system?
3. With respect to damping factor, give condition for critically damped and over-damped vibration.
4. Write differential equation for forced damped vibration and name all forces in the equation.
5. On which two parameters does the natural frequency of mass spring system depend? Write the relation.
6. Define natural frequency. What is the condition for resonance to occur?
7. What is transverse vibration of shafts? Write relation between natural frequency and static deflection (δ) of the shaft.
8. In viscous damping, what is the relation between damping force and damping coefficient? What is damping factor?
9. What conditions must be satisfied in order to achieve complete dynamic balance of reciprocating masses.
10. Compare the angular velocity and direction of rotation of direct crank and reverse crank.

Part – B

Answer any 5 out of 7 questions (5 x 10= 50 marks)

11. Derive natural frequency of simple pendulum of length 'L' having mass of bob 'm'. Use Newton's method.

12. Determine natural frequency of transverse vibration of a simply supported shaft 25 mm in diameter and 0.8 m long with a mass of 1 kg at mid span. The density of the shaft material is 50 g/cm^3. Young's modulus of the shaft is 2 x 10^6 bar. Use Dunkerley's method.

13. A two rotor system consists of five shafts connected in series. Length and diameter of first shaft is 27.5 cm and 7.5 cm respectively. Length and diameter of second shaft are 25 cm and 12.5 cm respectively. Length and diameter of third shaft are 37.5 cm and 9 cm respectively. Length and diameter of the fourth shaft are 10 cm and 18 cm respectively. Length and diameter of the fifth shaft are 25 cm and 12.5 cm respectively. Modulus of rigidity is 84×10^9 N/m^2. Find the natural frequency of torsional oscillations of the system using a torsionally equivalent system of diameter 7.5 cm.

14. A vibrating system consists of a mass of 7 kg, a spring of stiffness 50 N/cm and damper of damping coefficient 0.36 N-cm/s. Find the damping factor, the logarithmic decrement, ratio of two consecutive oscillations and angular velocity corresponding to damped vibrations.

15. A machine part of mass 2 kg vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in resonance amplitude of 1.25 cm for a period of 0.2 seconds.

16. A 50 mm diameter shaft is simply supported at the ends 3 m apart. Shaft carries three point loads of mass 100 kg, 150 kg and 75 kg at 1m, 2m, and 2.5m from the left hand support. The Young's modulus of the shaft material is 2×10^6 bar. Neglecting the mass of the shaft determine the whirling speed of the shaft.

17. A shaft carries four rotating masses A, B, C and D in four different planes. The masses are in complete dynamic balance. The masses B, C and D are 60 kg, 90 kg and 80 kg respectively. The masses C and D make an angle of 90 degrees and 200 degrees respectively with mass B in same direction. The masses A, B, C and D are concentrated at radii 80 mm, 105 mm, 55 mm and 95 mm respectively. Find mass of A and its angular position with mass B.

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