INDIAN MARITIME UNIVERSITY

(A Central University, Govt. of India)

B.Tech (Marine Engineering) - Semester IV

December 2015 End Semester Examinations

Mechanics of Machine - II

Subject Code: UG11T2403/UG11T1403

Time: 3 hrs | Max Marks: 100

Date: 16.12.2015 | Pass Marks: 50

Part – A

Compulsory Question (3 X 10 = 30 marks)

1. a) Explain the term static balancing and dynamic balancing. State necessary condition to achieve them.

   b) Explain hammer blow of a locomotive wheel.

   c) Draw the sketch and find the differential equation of motion of free vibration. Draw displacement vs. time curve and find time period.

   d) Draw a sketch of torsional pendulum and write down the differential equation of motion.

   e) Define torsionally equivalent shaft.

   f) Explain with sketch two node and single node torsional vibration of 3 – rotor system.

   g) Explain critical speed of rotor.

   h) Derive by energy method natural frequency of transverse vibration of a beam when several concentrated loads act on the beam.

   i) Draw a sketch of forced damped vibration and write down differential equation of motion from free body diagram.

   j) Explain the term "critical damping co-efficient". How it is related to "damping factor"

PART – B (5 X 14 = 70 marks)

Answer Any Five of the following

2. Four masses m1, m2, m3 and m4 are 200Kg, 300Kg, 240Kg, and 260Kg respectively and the angle between successive are 45^0, 75^0 and 135^0. Find the position and magnitude of the balance mass required if its radius of rotation is 0.2m. [14]

3. The position of a 60^o twin V-Engine has stroke of 160 mm. the connecting rods diving a common crank has a length of 240 mm, the mass of the reciprocating parts per cylinder is 2 kg and speed of crank shaft is 2500 rpm. Determine the magnitude of primary and secondary forces. Explain what will be value of relevant couples. [14]

4. Two spring in parallel, having stiffness 500 N/M and 550 N/M are fixed at one end, a mass of 10 kg is hanging from other end. Derive from first principle differential equation of motion of free vibration considering initial Displacement as x_o and find the equation of displacement, velocity and acceleration and also draw their curve with time. [14]

5. Find the natural frequency of transverse vibration of beam of Several concentrated load by Maxwell's energy method and Dunkerley's empirical equation of a simply supported beam. [14]

6. A shaft, 20 mm diameter, rotates in a spherical bearing with a span of 1.2 m and carries of rotor of mass 15 kg at mid point of two bearings. Neglect the mass of shaft. Determine dynamic deflection of shaft in terms of angular velocity, if the mass centre of the rotor is 0.25 mm out of alignment. a) find whirling speed of shaft. b) if the bending stress is not to exceed 120 MN/m^2, determine range of speed within which it is unsafe to run the shaft and their corresponding frequencies. Take $E=200GN/m^2$. [14]

7. A steel shaft is fitted with rotor A and B at two ends having mass moment of inertia of A is 650 Kgm^2 and B is 200 Kgm^2. The stepped shaft has 90 mm dia. and 600 mm long; 70 mm dia. and 500 mm long and 60 mm dia. and 400 mm long. Rotor A is fitted with 90 mm dia. shaft end and rotor B is fitted with 60 mm dia. shaft end. Find the actual location of node point and natural frequencies of torsional vibration. Take $G=80\ GN/m^2$. [14]

8. A mass of 15 Kg hangs from the spring and makes damped oscillation. The time of 55 complete oscillation requires 35 sec. the ratio of first amplitude to tenth consecutive amplitude is 3.5. Find spring stiffness and critical damping co-efficient of the system. [14]

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