INDIAN MARITIME UNIVERSITY

B.Tech (MARINE ENGINEERING)

June 2013 Examinations
FOURTH SEMESTER

MECHANICS OF MACHINES-II

Subject Code: UG/ME/BS/T/223 | **QP Code: T0511403**
Date: 13.06.2013 | **Max. Marks: 100**
Time: 3 Hrs

PART-A (10x3=30)

1. (a) Why rotating masses are to be dynamically balanced? Write different types of balancing.

(b) Can a single cylinder engine be fully balanced? Why?

(c) What is simple harmonic motion? Write the fundamental equation of S.H.M.

(d) Determine the natural frequency of mass of 10kg suspended at the bottom of two springs (of stiffness: 5 N/mm and 8 N/mm) in series.

(e) What is meant by degrees of freedom in a vibrating system?

(f) Explain the dunkerley's method used in natural transverse vibration?

(g) Define magnification factor. What are the factors on which it depends?

(h) What is vibration isolation? What are the methods of isolating the vibration?

(i) Define damping factor and damping coefficient?

(j) What is logarithmic decrement?

PART-B

(5x14=70)

2. (a) A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50kg, 80kg and 70kg respectively. The masses C and D make angles of 90^0 and 195^0 respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75mm, 100mm, 50mm and 90mm respectively. The plane of rotation of masses B and C are 250mm apart. Determine:
   i) the magnitude of mass A and its angular position and
   ii) the position of planes A and B. (8)

   (b) The pistons of a 60^0 twin V-engine has strokes of 120mm. The connecting rods driving a common crank has a length of 200mm. The mass of the reciprocating parts per cylinder is 1kg and the speed of the crank shaft is 2500 rpm. Determine the magnitude of the primary and secondary forces. (6)

3. (a) Explain the effect of inertia of the constraint in longitudinal vibrations. (7)

   (b) Derive the time period and natural frequency of free vibration of a compound pendulum. (7)

4. (a) Three rotors A, B and C having moment of inertia of 2000, 6000 and 3500 kg-m^2 respectively are carried on a uniform shaft of 0.35m diameter. The length of the shaft s between the rotors A and B is 6m and between B and C is 32m. Find the natural frequency and frequency of the torsional vibrations. The modules of rigidity for the shaft material is 80 GN/m^2. (7)

   (b) A marine engine, shaft and propeller are the approximately equivalent to the following three rotors system. The combined moment of inertia of the engine masses is 800 kg-m^2, that of the flywheel is 320 kg-m^2 and that of the propeller is 20 kg-m^2. The equivalent shaft between the engine masses and the wheel is 5 cm diameter and 200 cm long and that between flywheel and the propeller is 2.5 cm diameter and 200 cm long. Find the frequencies of torsional vibration of the system and the positions of the nodes. (7)

5. (a) The support of a spring-mass system is vibrating with an amplitude of 6mm and a frequency of 20 Hz. If the mass is 1.1 kg and the spring has a stiffness of 2000 N/m, determine the amplitude of vibration of the mass. What amplitude will result if a damping factor of 0.25 is inclined in the system? (7)

   (b) A machine 100 kg has a 20 kg rotor with 0.5mm eccentricity. The mounting springs have s=85 x 10^3 N/m. The damping ratio is 0.02. The operating speed is 600 rpm and the unt is constrained to move vertically. Find : (i) dynamic amplitude of the machine . (ii) The force transmitted to the supports (7)

6. a) Derive the equation for the transverse vibration of a uniformly loaded shaft (7)

b) A vertical steel shaft of 20 mm diameter is mounted in long bearings which are 1.2m apart and carries 150N of disc at its middle. The eccentricity of the centre of gravity of the disc from the centre of the rotor is 0.3mm. Taking young's modulus as $200GN/m^2$ and permissible stress a s $74MN/m^2$, Calculate the critical speed of the shaft and range of speed over which it is unsafe to run the shaft. (7)

7. a) An instrument vibrates with frequency of 1.24 Hz when there is no damping. When the damping is provided, the frequency of damped vibration was observed to be 1.03 Hz. Find i) the damping factor and ii) the logarithmic decrement. (7)

b) The successive amplitudes of vibrations of vibratory system as obtained under free vibration are 12, 9.3, 6.4, 3.8 and 1.2 mm respectively. Determine the damping ratio of the system. (7)

8. a) A machine part having a mass of 2.5 kg vibrates in a viscous medium. A harmonic exciting force of 30N acts on the part and cause a resonant amplitude of 14 mm with a period of 0.22 second. Find the damping coefficient. If the frequency of the exciting force is changed to 4 Hz, Determine the increase in the amplitude of the forced vibration upon the removal of the damper. (7)

b) A body having a mass of 15 kg is suspended form a spring which deflects 12mm under weight of the mass. Determine the frequency of the free vibrations. What is the viscous force needed to make the motion a periodic at a speed of 1 mm/s. If , when damped to this extent, a disturbing force having a maximum value of 100N and vibrating at 6Hz is made to act on the body, determine the amplitude of ultimate motion (7)

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