C 80806 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2015

ME/PTME 09 601—DYNAMICS OF MACHINERY

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. What are the conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque ?
2. Discuss how the inertia of the connecting rod accounted in a slide crank mechanism is accounted.
3. What is dynamic balancing with reference to rotating mass system ?
4. Define the term transmissibility.
5. What is torsionally equivalent shaft ?

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. Explain the D'Alembert's principle and its usage in the inertial force analysis.
2. Explain the effect of gyroscopic couple on aircrafts.
3. A vibrating system has the following data: mass, $m = 3$ kg, stiffness $k = 100$ N/m; Damping Coefficient C = 3N = sec./m. Determine the ratio of two successive amplitudes.
4. Determine the effect of the mass of the spring on the natural frequency of a spring mass system.
5. What do you mean by logarithmic decrement ? Derive an expression for logarithmic decrement in terms of damping factor.
6. Derive an expression for the natural frequency of free transverse vibration for a simply supported shaft carrying a uniformly distributed mass m kg. per unit length.

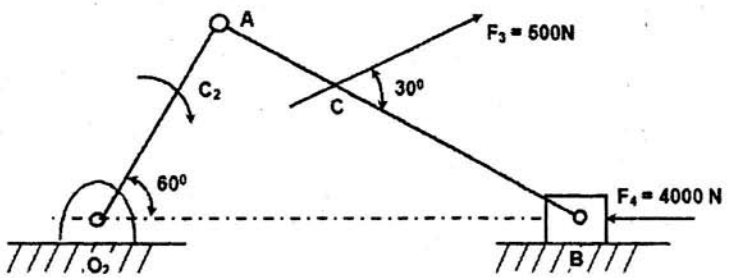
(4 × 5 = 20 marks)

Turn over

Part C

Module I

1. Determine the couple C_2 on crank to be applied for the equilibrium of the system given below. Also determine the resultant force F_{21} and F_{41} exerted on the frame of the engine. Given O_2A = 15 cm, AB = 45 cm, AC = 12 cm.



Or

2. In a four bar mechanism ABCD, the link AB revolves with an angular velocity of 10 rad/sec. and angular acceleration of 25 rad/sec^2. at the instant when it makes an angle of 45° with AD, the fixed link. The lengths of the links are : AB = CD = 800 mm ; BC = 1000 mm. and AD = 1500 mm. The mass of links is 4 kg/m. length. Determine the torque required to overcome the inertia forces, neglecting the gravitational effects. Assume all links to be of uniform cross-section.

Module II

3. A five cylinder in line engine running at 750 r.p.m. has successive cranks at 144°, apart the distance between the cylinder centre lines being 375 mm. the piston stroke is 225 mm. and the ratio of the connecting rod to crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the piston of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15 kg.

Or

4. A ship has a rotor of mass 3 tones rotating at 2500 r.p.m. and its radius of gyration is 30 cm. If the rotation of the rotor is clockwise looking from the stem, calculate the gyroscopic couple that is set on the ship by the rotor when (a) The ship takes a left turn with a radius of 400 m. at q speed of 50 km/hr. ; (b) pitching of the bow at an angular velocity of 4 rad/sec ; and (c) ship rolls due to the wave with a velocity of 0.1 rad/sec.

MODULE III

5. A vibrating system consists of a mass of 20 kg. a spring of stiffness, 20 kN/m. and a damper. The damping provided is only 30 % of the critical value. Determine the natural frequency of the damped vibration and the ratio of two successive amplitudes.

Or

6. A body having a mass of 15 kg. is suspended from a spring which deflects 12 mm. under weight of the mass. Determine the frequency of the free vibrations. What is the viscous damping 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 100 N and vibrating at 6 Hz. is made to act on the body, determine the amplitude of the ultimate motion.

MODULE IV

7. Two rotors A and B of mass 300 kg. and 500 kg. respectively are attached to the end of a shaft of 500 mm. long. The radii of gyration of A and B are 300 mm. and 450 mm. respectively. For the first 250 mm. the diameter of the shaft is 70 mm, for the next 70 mm. the diameter is 120 mm. and the remaining length the diameter is 100 mm. If modulus of rigidity is 80 GPa, find the position of node and frequency of torsional vibrations.

Or

8. (a) Discuss phase plane method in detail.

   (b) Explain the principle and working of vibration absorbers.

(4 × 10 = 40 marks)