C 1157 (Pages : 3)

Name .....

Reg. No .....

SIXTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, APRIL 2016

ME / PTME 09 601—DYNAMICS OF MACHINERY

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *the questions.*

Each question carries 2 *marks.*

1. What is friction circle ?
2. Define crank effort.
3. What are the effects of partial balancing of reciprocating engines ?
4. What are free, damped and forced vibrations ?
5. Define the term node.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

Each question carries 5 *marks.*

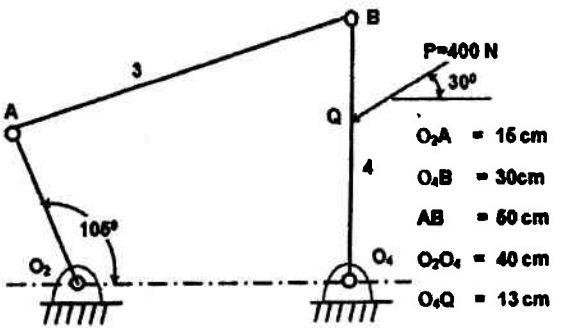
1. Explain the various steps involved in the static force analysis.
2. What do you understand by gyroscopic couple ? Derive a formula for its magnitude.
3. Determine the effect of the mass of the spring on the natural frequency of a spring mass system.
4. Derive an expression for the natural frequency of a spring mass system using energy method.
5. What do you mean by torsionally equivalent shaft ? Derive an expression for the equivalent length of a shaft which has several steps.
6. Derive an expression for the natural frequency of free transverse vibration for a simply supported shaft carrying a number of point loads.

(4 × 5 = 20 marks)

Part C

MODULE I

1. In a four bar mechanism shown below, find out the forces and couples acting on each link as well as those on the frame. Draw the free body diagram of each link. O_2A = 15 cm ; O_4B = 30 cm ; AB = 50 cm ; O_2O_4 = 40 cm ; O_4Q = 18 cm.



Or

2. The crank and connecting rod of a petrol engine, running at 1800 r.p.m. are 50 mm. and 200 mm. respectively. The diameter of the piston is 80 mm. and the mass of reciprocating parts is 1 kg. At a point during the power stroke, the pressure on the piston is 0.7 N/mm^2, when it has moved 10 mm. from the inner dead centre. Determine (i) Net load on the gudgeon pin (ii) Thrust in the connecting rod, (iii) Reaction between the piston and cylinder and (iv) The engine speed at which the above value becomes zero.

MODULE II

3. The cranks and connecting rods of a 4 cylinder in-line engine running at 1800 r.p.m. are 60 mm. and 240 mm each respectively and the cylinders are spaced 150 mm. apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine the unbalanced primary and secondary forces if any, and the unbalanced primary and secondary couples with reference to the central plane of the engine.

Or

4. The turbine rotor of a ship of mass 20 tones, radius of gyration 0.75 m. and speed 2,000 r.p.m. rotates in the clockwise sense when viewed from the front of the ship. The ship pitches harmonically with amplitude 10° and time period of 20 sec. The turbine shaft is supported on bearings 5 m. apart. Determine the maximum reaction at the front bearing and its direction when the bow of the ship is rising. The centre of gravity of the rotor is at midspan between bearings.

MODULE III

5. In a single degree damped vibrating system, a suspended mass of 8 kg. makes 30 oscillations in 18 seconds. The amplitude of vibration decreases to 0.25 of the initial value after 5 oscillations. Determine (i) The stiffness of the spring ; (ii) The logarithmic decrement ; (iii) The damping factor ; and (iv) The damping coefficient.

Or

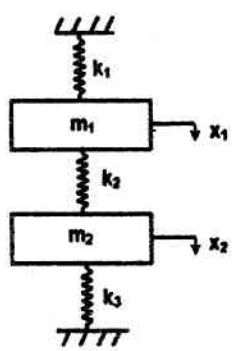
6. A machine part having a mass of 2.5 kg. vibrates in a viscous medium. A harmonic exciting force of 30 N acts on the part and causes resonant amplitude of 14 mm. with a period of 0.22 second. Find the damping coefficient. If the frequency of the exciting force is changed to 4 Hz, determine the increase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

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. Determine the frequency of the system shown in fig below. Given $k_1 = k_3 = 40$ N/m, $k_2 = 60$ N/m, $m_1 = m_2 = 0$ kg.



(4 × 10 = 40 marks)