C 61486 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION APRIL 2014

(2009 Scheme)

ME/PTME 09 601—DYNAMICS OF MACHINERY

[Regular/Supplement/Improvement]

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. What do you mean by Free Body diagram?
2. Differentiate between dynamic force analysis and static force analysis.
3. What is meant by primary balancing ?
4. Define the term under damping ?
5. What is phase plane ?

(5 × 2 =10 marks)

Part B

Answer any **four** *questions.*

1. Explain friction circle. Derive an expression for radius of friction circle. How does this friction circle radius vary with coefficient of friction ?
2. What is partial balancing ? What are the effects of partial balancing of reciprocating engines ?
3. Explain how a gyroscopic couple affects stability of a motorcycle negotiating a curved road ? Write the expression for angle of heel.
4. Determine the effect of the mass of the spring on the natural, frequency of a spring mass system.
5. Determine the time in which the mass in a damped vibrating system would settle down to $1/50^{th}$ of its initial deflection for the following data : m = 200 kg, damping factor ζ = 0.22 and stiffness k = 40 N/m.
6. Explain the method of finding the natural frequency of a torsional vibration of two rotor system.

(4 × 5 = 20 marks)

Turn over

Part C

Module I

1. Determine the input torque on the crank of a slider crank mechanism for static equilibrium when the piston load is 1500 N. The length of the connecting rod and the crank are 120 mm and 40 mm respectively and the crank has turned through 45° from the inner dead centre.

Or

2. In a four bar mechanism ABCD, AB = CD = 0.8 m ; BC = 1 m ; AD = 1.5 m. The link AB revolves with an angular velocity of 5 rad/sec and accelerates at 20 rad/sec^2 at the instant when it makes an angle of 45° with AD. AD is fixed link. The links are of 2 kg./m. length. Determine the torque required to overcome the inertia force.

Module II

3. A number of masses are attached to a shaft which is rotating at an angular speed of ω rad/s. If all the masses are in different planes then describe the analytical method and graphical methods of balancing these masses.

Or

4. One of the driving axles of a locomotive, with its two wheels, has a moment of inertia of 350 kg.-m^2. The wheels are 1.85 m. diameter. The distance between the planes of the wheels is 1.5 m. When travelling at 100 km/hr, the locomotive passes over a defective rail which causes the right wheel to fall 12 mm and rise again in a total time of 0.1 s, the vertical movement of the wheel being with SHM. Find the maximum gyroscopic torque caused and make a sketch of the direction in which it acts when the wheel is falling.

Module III

5. A machine is mounted on springs and fitted with a dashpot has a mass of 60 kg. There are three springs, each of stiffness 12 N/mm. the amplitude of vibrations reduces from 45 to 8 mm. in two complete oscillations. Assuming that the damping force varies as the velocity, determine (i) the damping coefficient, (ii) the ratio of frequencies of damped and undamped vibrations and (iii) the period time of damped vibrations.

Or

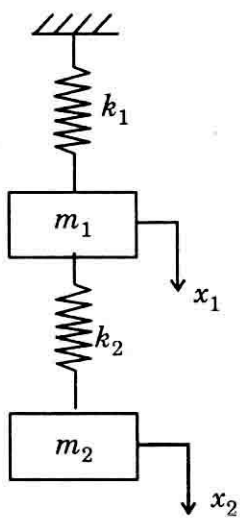
6. A machine weighing 3.5 kg. vibrates in a viscous medium. A harmonic exciting force of 40 N acts on the machine and produces resonant amplitude of 18 mm with a period of 0.2 second. Determine the damping coefficient.

MODULE IV

7. The moment of inertia of three rotors A, B and C are 0.3, 0.6, and 0.18 kg-m^2. The distance between A and B is 1.5 m. and between B and C is 1 m. The shaft is 70 mm diameter and the modulus of rigidity of the shaft material is 84 G Pa. Find the frequencies of torsional vibration.

Or

8. Fig. below shows a vibrating system having two degrees of freedom. Determine the two natural frequencies of vibration and the ratio of amplitudes of the motion of m_1 and m_2 for the two modes of vibration. Given m_1 = 1.5 kg, m_2 = 0.8 kg, $k_1 = k_2$ = 40 N/m.



(4 × 10 = 40 marks)