B.Tech.(ME) (Sem.–4)
# THEORY OF MACHINES – II
Subject Code : BTME-402
M.Code : 59130
Date of Examination : 20-11-2023

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION–A

1. Write briefly :

   a) What do you mean by free body diagram?

   b) Define point of concurrency.

   c) State D'Alembert's principle.

   d) What do you mean by 'Dynamic Force Analysis'?

   e) Explain the terms 'static balancing' and 'dynamic balancing'.

   f) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.

   g) Define the terms : (i) Module, (ii) Addendum.

   h) Briefly explain the differences between simple and compound gear train.

   i) What do you mean by 'Synthesis of Mechanisms'?

   j) Write a short note on gyroscope.

(S2)-252

1 | M-59130

SECTION-B

2. What are conditions for a body to be in equilibrium under the action of two forces, three forces and a torque?

3. A horizontal gas engine running at 210 rpm has a bore of 220 mm and a stroke of 440 mm. The connecting rod is 924 mm long and the reciprocating parts weigh 20 kg. When the crank has turned through an angle of 30° from the inner dead centre, the gas pressures on the cover and the crank sides are 500 kN/m² and 60 kN/m² respectively. Diameter of the piston rod is 40 mm. Determine (a) turning moment on the crank shaft (b) thrust on the bearings (c) acceleration of the flywheel which has a mass of 8 kg and radius of gyration of 600 mm while the power of the engine is 22 kW.

4. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gear is involutes with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.

5. Explain the method of balancing of different masses revolving in the same plane.

6. Give the classifications of synthesis problem.

SECTION-C

7. The three cylinders of an air compressor have their axes 120° to one another and their connecting rods are coupled to a single crank. The stroke is 100 mm and the length of each connecting rod is 150 mm. The mass of the reciprocating parts per cylinder is 1.5 kg. Find the maximum primary and secondary forces acting on the frame of the compressor when running at 3000 r.p.m. Describe clearly a method by which such forces may be balanced.

8. The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 3000 r.p.m. clockwise when looking from a stern. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots (1 knot = 1855 m/hr).

Also calculate the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 seconds and the total angular displacement between the two extreme positions of pitching is 12°. Find the maximum acceleration during pitching motion.

9. In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise.