SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | | **Total number of pages:[2]**

Total number of questions: 06

B.Tech. || ME || 4th Sem

Theory of Machine-II

Subject Code: BTME 402A

Paper ID:

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data, if any.**

PART A (2×10)

Q. 1. Short-Answer Questions: All COs

(a) Why balancing of machine is essential?
(b) How will you determine the gyroscopic couple?
(c) What is significance of inertia force analysis?
(d) What is D'Alembert principle?
(e) What are free body diagrams?
(f) What do you mean by partial balancing of reciprocating masses?
(g) How the application of a gear train differs from a gear?
(h) What is reverted gear train? Where it is used.
(i) What do you mean by term addendum and dedendum?
(j) How a helical gear differs from a worm gear? Give one application of each gear.

PART B (8×5)

Q. 2. The crank and connecting rod of a vertical engine running at 1800 rpm are 60 mm and 270 mm long respectively. The diameter of the piston is 100 mm and the mass of reciprocating parts is 1.2 kg. During the expansion stroke when crank has turned through 20° from top dead centre, the pressure of gas is 650 kN/m^2. Determine : COa

(a) Net force acting on piston
(b) Net load on the gudgeon pin
(c) Thrust on the cylinder
(d) Speed at which gudgeon pin load is reversed in direction.

OR

The piston diameter of an internal combustion engine is 125 mm and stroke length is 220 mm. The connecting rod is 4.5 times the crank length and has a mass of 50 kg .The mass of reciprocating parts is 30 kg.The centre of mass of connecting rod is 170 mm from the crank pin centre and radius of gyration about an axis through the centre of mass is 148 mm.The engine runs at a speed of 320 rpm. Determine the magnitude and direction of the inertia force and corresponding torque on the crankshaft when angle turned by crank is 140° from inner dead centre. COa

Q. 3. What is the superposition theorem? Discuss in detail how it is applicable to a system of forces acting on a mechanism by suitable illustration. COb

OR

What do you understand by dynamically equivalent system? Discuss in detail the requirements of dynamically equivalent systems with the help of neat sketch? COb

Q. 4. The four masses m_1,m_2, m_3 and m_4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 mm are 200kg, 300 kg ,240kg and 260 kg in magnitude respectively. The angles between successive masses are 45°, 75° and 135° respectively. Determine the position and magnitude of balance mass required if its radius of rotation is 200 mm. COc

OR

How a cycloidal tooth profile differs from an involutes tooth profile? Derive an expression for the minimum number of teeths to avoid the interference? COc

Q. 5. A rotating shaft carries four unbalanced masses 18 kg, 14 kg, 16 kg and 12 kg at radii 50 mm, 60 mm, 70 mm and 60 mm respectively. The 2^{nd} ,3^{rd} and 4^{th} masses revolve in the planes 80 mm, 160 mm and 280 mm respectively measured from the plane of first mass and are angularly located at 60°, 135° and 270° respectively measured anticlockwise from the first mass when viewing from this mass end of the shaft. The shaft is dynamically balanced by two masses both located at 50 mm radii and revolving in the planes mid way between 1^{st} and 2^{nd} mass and midway between those 3^{rd} and 4^{th} masses. Determine graphically or otherwise the magnitudes of the masses and their respective angular positions. COd

OR

How a simple gear train differs from a compound gear train? Explain the working of a compound epicyclic gear train with the help of a neat sketch? List few applications of epicyclic gear train. COd

Q. 6. What is meant by kinematic synthesis of a mechanism? Discuss various techniques which can be adopted for kinematic synthesis of a mechanism? COe

OR

What is effect of gyroscopic couple on the stability of a vehicle? Derive an expression for stability of four wheel vehicle moving on a curved path? COe