

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ME) (2012 Onwards) (Sem.-4)

**THEORY OF MACHINES – II**

Subject Code : BTME-402

M.Code : 59130

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) Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them.
- b) Define 'inertia force' and 'inertia couple'.
- c) How the different masses rotating in different planes are balanced?
- d) What are the advantages and applications of involute tooth profile?
- e) Differentiate between reverted and compound gear trains.
- f) What do you understand by gyroscopic couple? What is the effect of gyroscopic couple on bearings?
- g) What is the point of concurrency?
- h) Write the various necessary conditions for an equivalent dynamical system.
- i) What do you understand by three point synthesis?
- j) Why in static force analysis, a free body diagrams is required?

**SECTION-B**

**2. For the four bar linkage, the following data are given :**

$$\bar{\alpha}_2 = 60^\circ, \bar{\alpha}_4 = 90^\circ, \bar{\omega}_2 = 3 \text{ rad/sec}, \bar{\omega}_3 = -1 \text{ rad/sec}^2, \bar{\omega}_4 = 2 \text{ rad/sec}, \bar{\omega}_5 = 0$$

Determine the link length ratios with the help of Freudenstein's equation.

3. What are the free body diagrams of a mechanism? Explain the implementation of this concept for a slider-crank mechanism.
4. Explain the 'direct and reverse crank' method for determining unbalanced forces in radial engines.
5. A pinion of 20 involute teeth and 12.5 cm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25 mm. What is the least pressure angle which can be used to avoid interference?
6. Discuss the least square technique. How is it useful in designing a four link mechanism when three positions of the input and output link are known?

### SECTION-C

7. A single cylinder vertical engine has a bore of 30 cm, a stroke 36 cm and a connecting rod of length 72 cm. The weight of the reciprocating part is 130 kg. When the piston is at quarter stroke from TDC and is moving downwards, the net pressure on it is 0.6 MPa. If the speed of the engine is 250 *r.p.m.*, calculate the turning moment on the crankshaft at the instant corresponding to the position stated above.
8. Two shafts A and B are coaxial. The gear C (50 teeth) is rigidly mounted on shaft A and a Compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. Gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B.
  - a) Sketch the arrangement.
  - b) Find the number of teeth on internal gear G assuming that all gears have the same module.
  - c) If the shaft A rotates at 110 *r.p.m.*, find the speed of shaft B.
9. Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve with neat and clean diagram.

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**