

**Theory of Machines-II**  
**(ME-204/206, DEC 2006)**

Time: 3 Hrs  
Max Marks: 60

**Note:** Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

**Section-A**

1. a) What is dynamically equivalent system?  
b) What are effects of partial balancing?  
c) Give the applications of gyroscope.  
d) What is hammer blow? What are its effects?  
e) Give the applications of worm and wheel.  
f) Define (i) Circular pitch (ii) Working depth of teeth  
g) What is interference in gears?  
h) What is Grubler's criterion for plane mechanisms?  
i) What is function generation as applied to Kinematic synthesis of mechanisms?  
j) What is method of superposition in static force analysis?

**Section-B**

2. a) Define swaying couple, variation in Tractive effort.  
b) Explain how the V-engines are balanced?
- 3 With a neat sketch derive the minimum number of teeth on the pinion in order to avoid interference.
4. Define gyroscopic couple. Discuss the effect of gyroscopic couple on supporting and holding structures of machines.
5. Derive Freudenstein's equation for a four bar linkage.
6. Carry out the static force analysis of a slider-crank mechanism when a force P is acting on the piston and the system is kept in equilibrium by applying a couple on the crank.

**Section-C**

7. In a four bar link mechanism shown in figure 1, torque  $T_3$  and  $T_4$  have magnitudes of 30 N-m and 20 N-m respectively. The link lengths are AD = 800 mm, AB = 300 mm, BC = 700 mm and CD = 400 mm. For the static equilibrium of the mechanism, determine the required input torque  $T_2$ .  
Figure.1
8. The effective steam pressure on the piston of a vertical steam engine is 20 N when the crank is  $40^\circ$  from the inner dead centre on the down stroke. The crank length is 300 mm and the connecting rod length 1200 mm. The diameter of the cylinder is 800 mm. What will be the torque on the crank shaft if the engine speed is 300 rpm and the mass of the reciprocating parts 250 kg?
9. In an epicyclic gear train an annular wheel 'A' having 54 teeth meshes with a planet wheel 'B' which gears with a sun wheel 'C', the wheels 'A' and 'C' being co-axial. The wheel B is carried on a pin fixed on one end of arm P which rotates about the axis of the wheels A and C. If the wheel A makes 20 rpm in a clockwise sense and the arm rotates at 100 rpm in the anticlockwise direction and wheel C has 24 teeth, determine rpm and sense of rotation of the wheel C.