Theory of Machines-II
(ME-204/206, MAY 2007)

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) Define 'Inertia Torque'.
   b) What is the difference between 'Crank effort' and 'Crank pin effort'?
   c) Define 'Hammer blow' w.r.t. balancing.
   d) Why balancing of rotating parts of an engine in necessary?
   e) Define the term 'Pitch point' w.r.t. gears.
   f) Define 'Normal pitch' relating to helical gears.
   g) What is the difference between face and flank of a gear tooth?
   h) What do you understand by a gear train?
   i) What do you mean by Klein's Velocity diagram?
   j) What is the meaning of term 'Gyroscopic Stabilization'?

Section-B

2. Derive an expression to find out inertia force in the reciprocating parts neglecting the weight of the connecting rod.
3. Derive an expression for variation in Tractive force.
4. A pinion of 20 involute teeth and 120 mm pitch circle diameter drives a rack. The addendum of both the pinion and rack is 6.00 mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and minimum number of teeth in contact at a time?
5. In an epicyclic gear train, an arm carries two wheels A and B having 24 and 30 teeth respectively. The arm rotates at 100 rpm in the clockwise direction. Find the speed of the gear B on its own axis, when the gear A is fixed. If instead of being fixed, the wheel A rotates at 200 rpm in the counter clockwise direction, what will be the speed of B?
6. Explain the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn.

Section-C

7. a) Derive an expression to find out inertia force in the reciprocating parts neglecting the weight of the connecting rod.
   b) Discuss the partial balancing of unbalanced primary force in a reciprocating engine.
8. A four cylinder engine has the two outer cranks at 120° to each other and their reciprocating masses are each 400 kg. the distance between the planes of rotation of adjacent cranks are 400 mm, 700 mm and 500 mm. Find the reciprocating mass and the relative angular position for each of the inner cranks, if the engine is to be complete primary balance. Also find the maximum unbalanced secondary force, if the length of each crank is 360 mm, the length of each connecting rod 1.6 m and the engine speed 550 rpm.
9. a) A pinion with 24 involute teeth of 150 mm of pitch circle diameter drives a rack. The addendum of the pinion and rack is 6 mm. Find the least pressure angle which can be used if undercutting of the teeth is to be avoided. Using this pressure angle, find the length of arc of contact and the minimum number of teeth in contact at one time.
   b) The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration of 0.5 mm. It rotates at 2000 rpm clockwise, when looking from the sterns. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steers to the left in a curve of 80 m radius.