

**End Semester Examinations - 2015-16 Even Semester - May 2016**

**14ME2026 Mechanics of Machines**

**Set A**

**Time : 3 hrs**  
**Total Marks: 100**

1. Sketch and explain the various inversions of a single slider crank chain.  
**OR**
2. A) Explain the terms: 1. Lower pair, 2. Higher pair, 3. Kinematic chain, and 4. Inversion. (4x2 = 8marks)  
B) Explain the types of joints in a chain.
3. The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45 degree from the inner dead centre position, determine: 1. velocity of piston, 2. angular velocity of connecting rod, 3. velocity of point E on the connecting rod 1.5 m from the gudgeon pin.  
**OR**
4. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine: 1. linear velocity and acceleration of the midpoint of the connecting rod, and 2. angular velocity and angular acceleration of the connecting rod, at a crank angle of 45 degree from inner dead centre position.
5. A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.  
**OR**
6. Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam.
7. Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find: 1. The angle turned through by pinion when one pair of teeth is in mesh ; and 2. The maximum velocity of sliding.  
**OR**
8. 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 rpm clockwise.
9. A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 KW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is 1. an open belt drive, and 2. a cross belt drive. Take  $\mu = 0.3$ .

**Wishing you All the Best**