

(3 Hours)

Total Marks 80

- N.B:**
- 1) Question No. 1 is **compulsory**.
  - 2) Attempt any **three** questions out of remaining **five** questions
  - 3) Assume suitable data wherever necessary but justify the same
  - 4) Figures to the right indicate Marks

1. Answer any **four** of the following questions **20**

- i) What are the different types of instantaneous centres?
- ii) Classify cam in detail
- iii) Explain Self energizing and Self-locking brake
- iv) What are the different types of constrained motion?
- v) State and explain work energy principle and conservation of energy

2. (A) The mechanism, as shown in Fig. 1 the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter clockwise direction at a speed of 180 r.p.m. The dimensions of various links are as follows: OA = 180 mm; CB = 240 mm; AB = 360 mm; and BD = 540 mm. For the given configuration, find:
1. Velocity of slider D,
  2. Angular velocity of links AB, CB, and BD
1. By instantaneous center method
  2. By relative velocity method

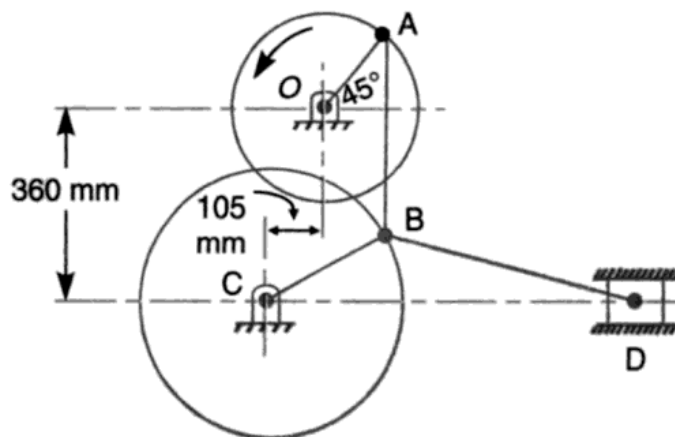
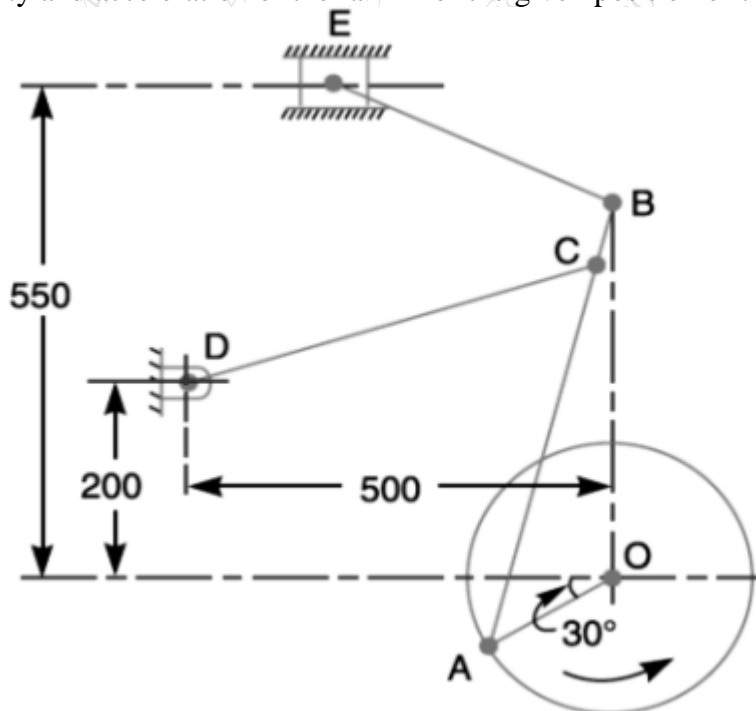


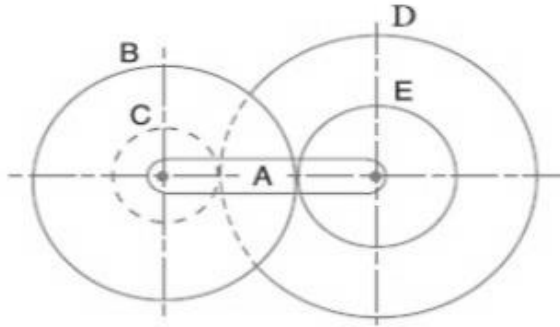
Fig. 1

- (B) Draw a neat sketch of Tchebicheff mechanism and prove that the length of links must be in a ratio of 1:2:2.5 **08**
3. (A) Figure shows the mechanism of a radial valve gear. The crank OA turns uniformly at 150 rpm and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as center and DC as radius. The dimensions of various links are OA = 150 mm; AB = 550 mm; AC = 450 mm; DC = 500 mm; BE = 350 mm. Determine velocity and acceleration of the ram F for the given position of the mechanism. **14**



- (B) What is the effect of centrifugal tension on power transmitted in belt drive? **06**
4. (A) In an open belt drive, the diameters of the larger and smaller pulley are 1.2 m and 0.8 m respectively. The smaller pulley rotates at 320 rpm. The center distance between the shafts is 4 m. When stationary, the initial tension on the belt is 2.8 kN. The mass of belt is 1.8 kg/m and the coefficient of friction between the belt and pulley is 0.25. Determine the power transmitted. **10**
- (B) A cord wrapped around a solid cylinder of radius 'r' and mass 'm'. The cylinder is released from rest. Determine the velocity of its centre of mass after it has moved down a distance 'h'. **10**

5. (A) 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 r.p.m. clockwise **10**



- (B) Compare involute and cycloidal gear teeth profiles **05**
- (C) What is chordal action in chain? **05**
6. (A) The number of teeth on each of the two equal spur gears in mesh is 50. The teeth have  $20^\circ$  involute profile and the module is 6 mm. If the arc of contact is 1.65 times the circular pitch. Find the addendum. **10**
- (B) A cam is rotating at 200 rpm operate a reciprocating roller follower of radius 2.5 cm. The least radius of cam is 30 mm, stroke of follower is 5 cm. Ascent takes place by uniform acceleration and deceleration and descent by simple harmonic motion. Ascent takes place by  $70^\circ$  and descent during  $50^\circ$  of cam rotation. Dwell between ascent and descent  $60^\circ$ . Sketch displacement, velocity, acceleration, and jerk diagram. **10**