Seat No	

S.Y.B.Tech. (Part-II) (Semester - IV) (CBCS)

Examination, May– 2025

Mechanical

Theory of Machines – I

Sub. Code : 79122

Day and Date : Wednesday, 21/05/2025 **Total Marks :70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions :
1. **Figures to the right indicate full marks.**
2. **Use of non-programmable calculator is allowed.**
3. **Assume suitable data wherever necessary.**

Q.1) A) What do you mean by inversion? Explain any two inversions of four bar chain. **(6)**

OR

Sketch and explain lower and higher pair with examples.

B) The crank and connecting rod of a reciprocating engine shown in fig 1. are 150 mm and 600 mm respectively. The crank is rotating in clockwise direction at 300 rpm. Find with the help of Klein's construction, Velocity and acceleration of the piston. **(6)**

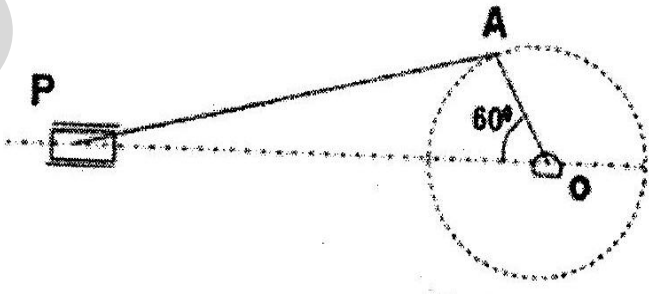

Fig. 1

Q.2) Find out the velocity and acceleration of the slider D for the engine mechanism shown in Fig. 2. The crank OA rotates uniformly at 180 rpm in clockwise direction. The various lengths are: OA = 150 mm; AB = 450 mm; $PB = 240$ mm; BC = 210 mm; CD = 660 mm. **(12)**

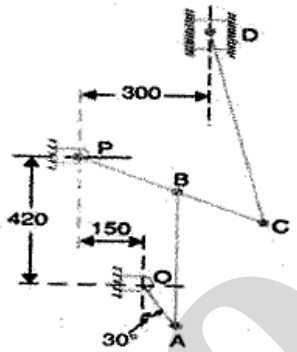

Fig. 2

Q.3) **A)** Derive equation for power required to lift the load by a screw jack. **(5)**

OR

Derive the equation for torque required to overcome in pivot bearing using uniform wear theory.

B) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN . The angle of the cone is 120° and the coefficient of friction is 0.025 . Find the power lost in friction when the speed is 140 rpm . Assume 1. Uniform pressure. 2. Uniform wear **(6)**

Q.4) **A)** Define with neat diagram (i) Base Circle (ii) prime circle. **(4)**

B) A cam, with a minimum radius of 40 mm , rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below : **(8)**

1. To raise the valve through 60 mm during 120° rotation of the cam;
2. To keep the valve fully raised through next 30°;
3. To lower the valve during next 60° and
4. To keep the valve closed during rest of the revolution, i.e. 150°.

The diameter of the roller is 25 mm. Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion.

Q.5) **A)** Explain with neat sketch any two types of belt drives. **(4)**

OR

Derive an equation for centrifugal tension in the belt.

B) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rpm, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? **(8)**

Q.6) **A)** Define Sensitivity and hunting of governor. **(4)**

OR

Explain Hartnell Governor with neat sketch.

B) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg . The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, governor effort and power of the governor when the friction at the sleeve is neglected. **(7)**