

(3 Hours)

[Total Marks: 80

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

1. Write short note on any 4 of the following

20

- Types of kinematic pairs
- Pantograph mechanism
- Types of gear trains
- Compliant mechanisms
- Classification of followers

2. (a) A thin rod 5 m long weighing 15 kg is suspended at 1m from the top as shown in figure 1. It is inclined 40 degrees with the vertical and released. Determine angular acceleration of the rod and the acceleration of bottom point B immediately after release.

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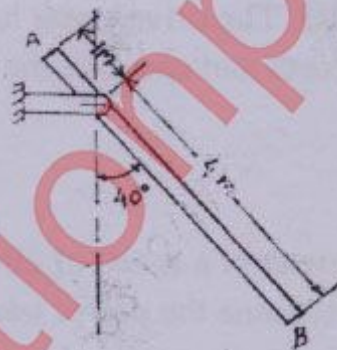


Figure 1

- What are complex mechanisms? Explain how low degree of complexity mechanisms can be analyzed.
- Explain Grublers criteria for planer mechanisms.

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3. (a). In the mechanism shown in figure 2 dimensions of various links are $AB = 15\text{mm}$, $BC = 45\text{mm}$

14

$CD = 50\text{ mm}$ $FE = 40\text{ mm}$. The crank AB rotates at a uniform speed of 30 rpm clockwise. When the angle made by crank is 60 degrees determine

- Velocity of slider E
- Angular velocity of DC and
- The rubbing velocity at pin C which is 6mm in diameter

TURN OVER

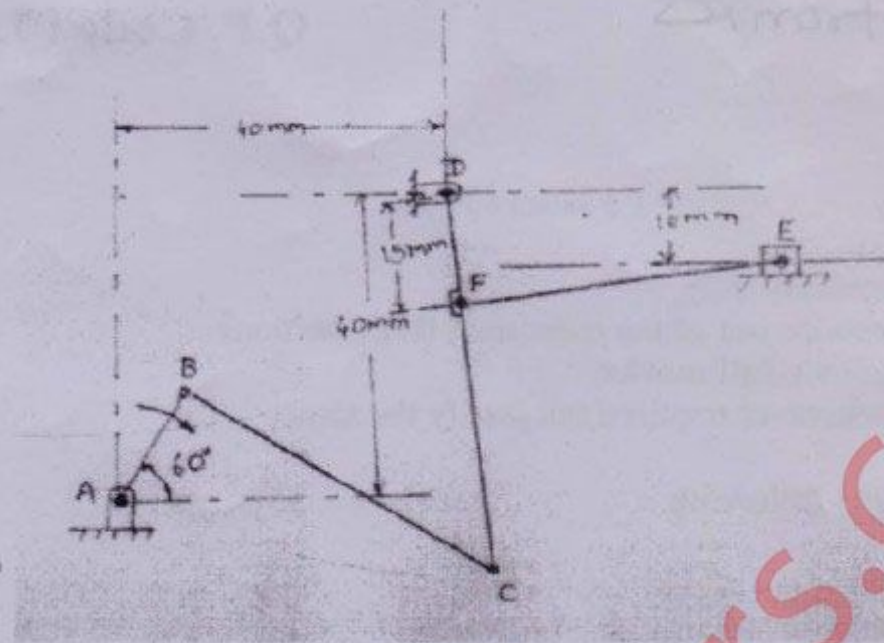


Figure 2

- (b) Prove that peaucellier mechanism is an exact straight line mechanism 6
- 4 (a) Synthesize a 4R mechanism O_2ABO_4 to follow following input output relation. ($\theta_2^{12} = 30^\circ$, $\theta_4^{12} = 45^\circ$) and ($\theta_2^{13} = 45^\circ$, $\theta_4^{13} = 90^\circ$). Assume $O_2O_4 = 5$ cm, $O_2A_1 = 6$ cm and angle $O_4O_2A_1 = 30^\circ$). 14
- (b) Two spur gears have a velocity ratio of $2/3$. The driven gear has 36 teeth of 10mm module and rotates at 150 rpm. Calculate number of teeth and speed of the driver. What will be the pitch line velocity? 6
- 5 (a) A Belt runs over a pulley of 600 mm diameter at a speed of 200rpm. The angle of lap is 165° and the maximum tension in belt is 3 KN. Determine the power transmitted if coefficient of friction between the belt and pulley is 0.3. 8
- b)(i) What are precision points? Why are they needed in kinematic synthesis? 6
- (ii) Differentiate between kinematic analysis and kinematic synthesis 6
- 6 (a) Draw the profile of a cam operating a knife edge follower having a lift of 40mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60° . The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at uniform velocity of 150 rpm and has a least radius of 30mm. What will be the maximum velocity and acceleration of the follower during lift and return? 14
- (b) Explain law of gearing with diagram 6