Code No: 114CY **R13**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B.Tech II Year II Semester Examinations, May - 2016**
**KINEMATICS OF MACHINERY**
**(Automobile Engineering)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A** **(25 Marks)**

1.a) Distinguish between copied and generated types of straight line motion mechanisms. [2]
b) Distinguish between the rolling, screw and spherical pairs. [3]
c) When do you get Coriolis component of acceleration in mechanisms? [2]
d) A four-bar chain ABCD is shown in the figure 1 below. How do you get the instantaneous center $I_{13}$ graphically? [3]

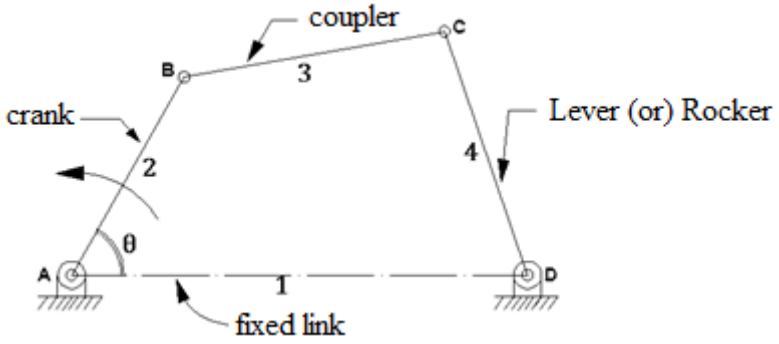


**Figure: 1**

e) What are the merits of Ackermann steering gear over Davis steering gear? [2]
f) What are the different types of cams used in practice? Explain briefly with sketches. [3]
g) What is the purpose of the Differential gear in an automobile? [2]
h) What is 'Undercutting' in gears, and when does it occur? [3]
i) What are the common materials used for belt and rope drives? [2]
j) Give the classification of chains. [3]

**PART-B** **(50 Marks)**

2.a) Draw a neat sketch of Peaucellier mechanism, and show that it produces an exact straight line motion.
b) In a kinematic chain having three links, the links are joined to each other by turning pairs in such a way as to form a triangle. Prove that the chain is locked. [6+4]



**OR**

3.a) Explain the working of Watt's straight line motion mechanism.

b) The Figure 2 shows some four-bar mechanisms in which the figures shown on the links indicate their lengths in standard units. Indicate the type of each mechanism, based on analytical reasoning. [4+6]

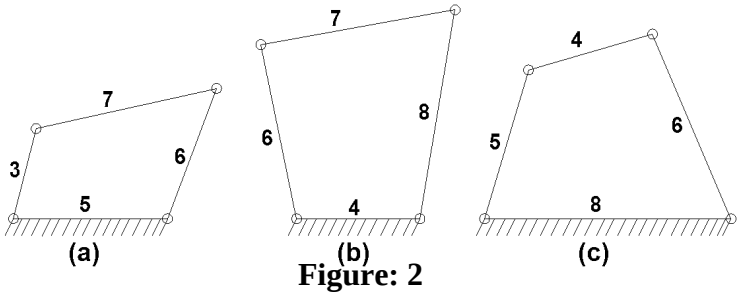


**Figure: 2**

4. The dimensions of various links in the mechanism shown in Figure 3 are OA = 0.5m; AB = 1.5m; AC = CD = 0.9m. The crank OA has uniform angular speed of 180 rpm. Determine the velocities of the sliders B and D ***by the Instantaneous centre method.*** [10]

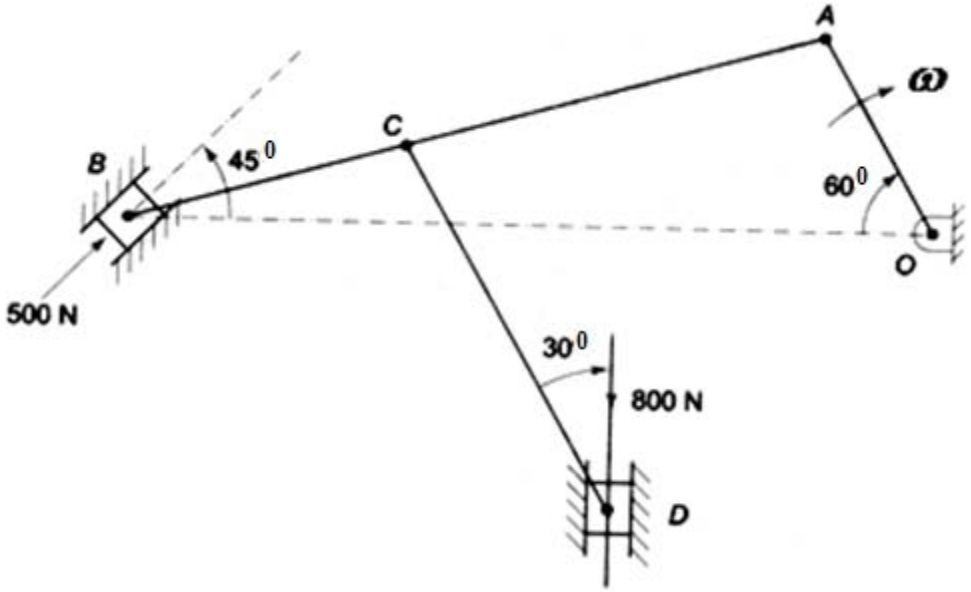


**Figure: 3**

**OR**

5. A double slider-crank mechanism is shown in Figure 4**.** Crank 2 rotates at constant angular velocity $\omega_2 = 10$ rad/s. Determine the velocity and acceleration of sliders. [10]

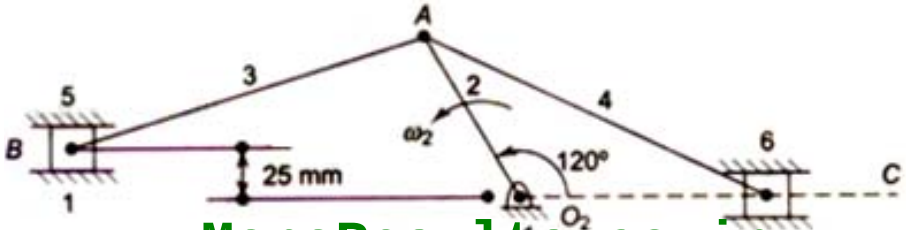




**Figure: 4**

6.a) Explain why two Hooke's joints are used to transmit motion from the engine to the differential of an automobile.

b) Derive the relations for the maximum velocity and acceleration of a roller follower moving over a tangent cam, when the roller is on the flank. [4+6]

**OR**

7.a) A Hooke's joint is used to connect two shafts. The driving shaft is rotating uniformly with a speed of 600 rpm. The maximum speed of the driven shaft is 630 rpm. Find the minimum speed of the driven shaft.

b) A cam with base circle diameter of 40 mm has a knife edge follower. The follower rises through 30 mm with uniform velocity during $180^0$ of cam rotation, followed by a dwell period of $36^0$, and then returns to the initial position if the cam rotates in counter-clockwise direction, draw the profile of the cam *up to the ascent and dwell*. [4+6]

8. Two spur gear wheels have 30 teeth each of involute profile. The circular pitch is 25 mm, and pressure angle is $20^0$. Determine the addendum of the wheels if the arc of contact is twice the circular pitch. [10]

**OR**

9. In a sun and planet type epicyclic gear train shown in the Figure 5, the pitch circle diameter of the internally toothed ring 252 mm and the module is 3.5 mm. The ring D is stationary. The spider A which carries three planet wheels P of equal size is to make one revolution in the same sense as the sun wheel S for every 5 revolutions of the driving spindle carrying the sun wheel S. Determine the appropriate number of teeth for all the wheels. [10]

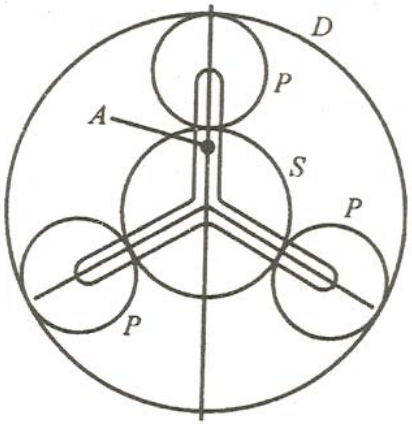


**Figure: 5**

10. A rope pulley having a mean diameter of 1.5 m rotates at 90 rpm. The angle of lap is $170^0$, and the pulley groove angle is $45^0$. The safe tension per rope is 750 N, and the coefficient of friction between the ropes and sides of the groove is 0.25. Calculate the number of ropes required to transmit 50 kW of power. [10]

**OR**

11. The maximum allowable tension in a flat belt is 1500 N. The angle of lap is $120^0$, and the coefficient of friction between the belt and pulley material is 0.27. Neglecting the effect of centrifugal tension, calculate the net driving tension and the power transmitted, if the belt speed is 2 m/s. [10]



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