

**B. E. MECHANICAL ENGINEERING (PART TIME) FIRST YEAR
SECOND SEMESTER EXAM 2017 (OLD)
KINEMATICS OF MACHINES**

Time: 3 hours

Full Marks: 100

(Answer question no.1 and any five from the rest)

(Assume data if required)

(Give answer to the different parts of a question together)

1. a) Determine the degrees of freedom of the following mechanisms shown in the figure 1.

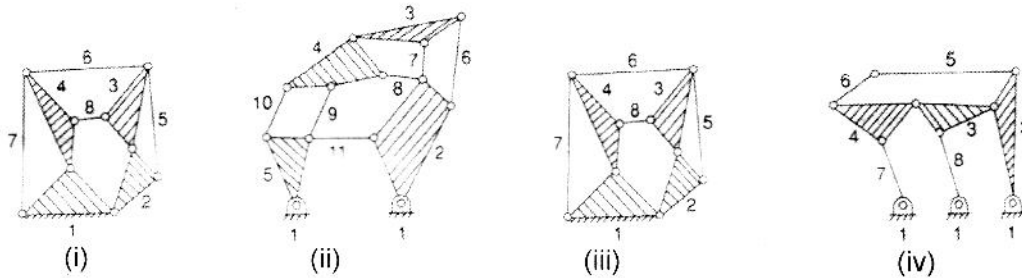


Figure 1

- b) Show that the slider crank mechanism is a modification of the basic four bar mechanism.
c) Indicate the type of each mechanism in the figure 2, whether crank-rocker or double rocker or double crank. Dimensions are given in standard units of length.

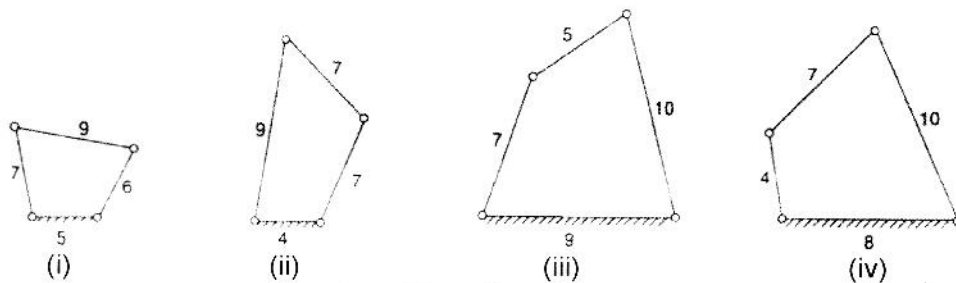


Figure 2

- d) Show that hand pump is an inversion of single slider crank mechanism.

$$8+4+4+4=20$$

2. a) Sketch and describe Crank and slotted lever mechanism. Find the time-ratio of cutting stroke to return stroke and the stroke length. Why is it called quick return mechanism?
b) Explain Kutzbach's criteria.

$$10+6=16$$

3. a) Derive the expression of transmission angle as a function of crank rotational angle and length of the links with respect to a typical four bar chain. Also find the maximum and minimum transmission angles.

[Turn over

- b) Find the maximum and minimum transmission angles for the mechanisms shown in the figure 3. The figures indicate the dimensions in standard units of length.

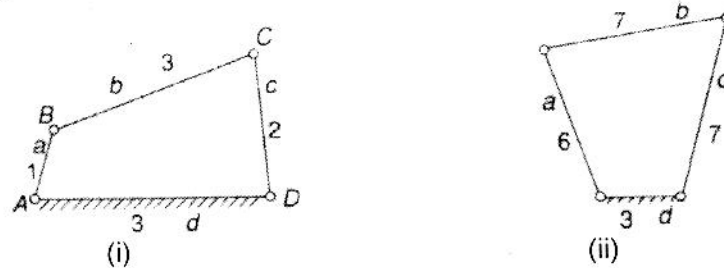


Figure 3

- c) What is the significance of a transmission angle? What is the limiting value?
8+4+4=16
4. a) State and drive the laws of gearing.
b) Define pressure angle of a gear tooth profile.
b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is Involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio.
6+2+8=16
5. a) Explain different types of gear train with sketches.
b) Explain with sketches: Involute tooth profile; Cycloidal tooth profile;
b) Derive the expression of minimum no. of teeth to avoid interference while two spur gears with involute profile in mesh.
4+4+8=16
6. The various dimensions of the mechanism, as shown in figure 4, are OA=120mm, AB=500mm, BC=120mm, CD=300mm and DE=150mm. the crank OA rotates at 150 rpm in CCW direction. The bell crank lever is DE. Determine the absolute velocity of point E. Use graphical method.

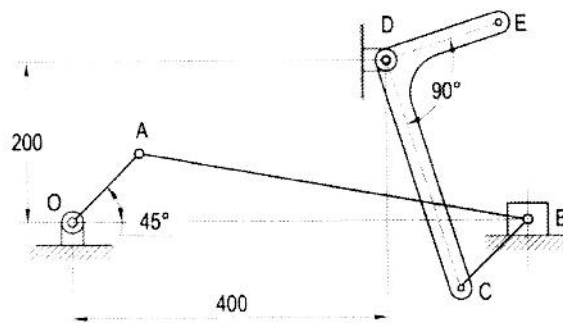


Figure 4

7. a) For the gear train in the fig. 5, shaft A rotates at 300 rpm and shaft B at 600 rpm in the directions shown. Determine the speed and the direction of rotation of shaft C.

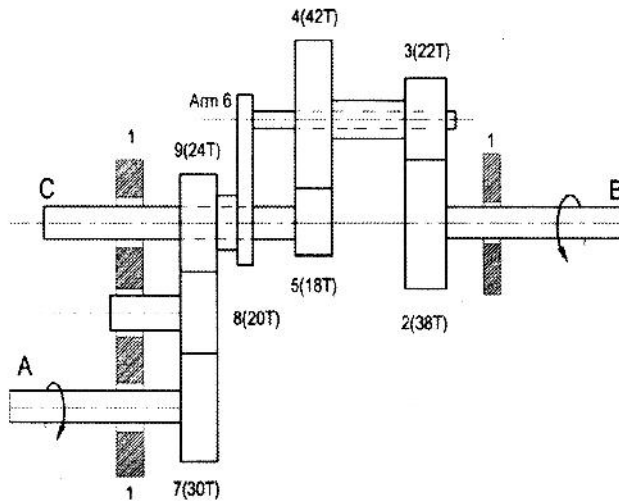


Figure 5

- b) Describe different types of cam and follower with sketches. Classify different types of follower motion.

8+8=16

8. Write short notes on (any four):
- Toggle mechanism
 - Resolution and composition method
 - Grashoff's criteria
 - Paucellier mechanism
 - Instantaneous center

4+4+4+4=16