

Roll No.

24170

B. Tech 4th Semester (Mechanical Engg.)

Examination – May, 2013

KINEMATICS OF MACHINE

Paper : ME-204-F

Time : Three hours]

[Maximum Marks : 100

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* out of nine questions. Question No. 1 is *compulsory*. Attempt *one* question from each section is *compulsory*. All questions carry equal marks.

1. (a) Define kinematic pair. 2 x 10
(b) What do you mean by inversion of mechanism ?
(c) Define Kennedy's theorem.
(d) Define relative velocity method of velocity determination.

- (e) Name the different motions that a follower can have.
- (f) Define path of approach.
- (g) What are the advantages of epicyclic gearing ?
- (h) State the law of solid friction.
- (i) Define the creep of belt.
- (j) List the types of pulleys.

SECTION-A

2. (a) Write a short note on the classification of kinematic pair. 10
- (b) Explain with the help of neat sketch a quick return mechanism which is used in elliptical trammel. 10
3. The crank and connecting rod of a horizontal steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clockwise directions. When it has turned 45° from the inner dead center position determine :

- (i) Velocity of piston
- (ii) Angular velocity of connecting rod
- (iii) Velocity of point E on connecting rod from 1.5 m from the gudgeon pin.
- (iv) Velocity of rubbing at the pins of the crank shaft, crank and cross-head when the diameters of their pins are 5 cm, 3 cm, 6 cm respectively.
- (v) Position and linear velocity of any point G on the connecting which has the least velocity relative to the crank-shaft.

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SECTION-B

4. A cam with 40 mm as minimum diameter is rotating clockwise at a uniform speed of 900 rpm and has to give the following motion to a roller-follower 10 mm in diameter :

- (i) Follower to complete outward stroke of 30 mm during 90° of cam rotation with equal uniform acceleration and retardation.
- (ii) Follower to dwell for 60° of cam rotation.

(iii) Follower to return to its initial position during 120° of cam rotation with equal uniform acceleration and retardation.

(iv) Follower to dwell for the remaining 90° of cam rotation. Draw the cam profile if the axis of the roller-follower passes through the axis of the cam. Determine the maximum velocity of the follower during the outstroke and return stroke and also the uniform acceleration of the follower on the outstroke and return stroke. 20

5. The angle between two meshing spiral bears is 90° and centre is 150 mm approximately. The normal circular pitch of the gears is 10 mm and the gear ratio is 2.5. The frictional angle is 6° and efficiency of the drive is maximum. Determine:

(i) The spiral angles of the teeth

(ii) The circular pitches of the gears

(iii) The number of teeth on each wheel

(iv) The exact centre distance and pitch circle diameters of the two wheels

(v) The efficiency of the drive.

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SECTION-C

6. In a reverted epicyclic train, the arm F carries two wheels A and D and a compound wheel B-C. The wheel A meshes with wheel B and the wheel D meshes with wheel C. The numbers of teeth on wheel A, D and C are 80, 48 and 72 respectively. Find the speed and direction of wheel D when wheel A is fixed and arm F, makes 200 rpm clockwise.

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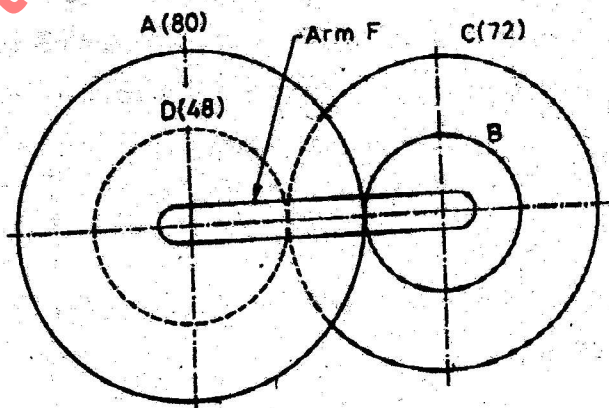


Fig. (i)

7. Determine the lengths of all the four links in a four bar chain for the length of the smallest being 10 cm to generate $y = \log_{10} x$ in the interval $1 \leq x \leq 10$ for three accuracy points. The range of the angles of input link and output link are.

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$$45^\circ \leq \theta \leq 105^\circ \text{ and } 135^\circ \leq \phi \leq 250^\circ$$

SECTION-D

8. (a) Explain the types of friction and laws of friction. 10
- (b) Find the power lost in friction assuming (i) uniform pressure and (ii) uniform wear when a vertical shaft of 100 mm diameter rotating at 150 rpm rests on a flat end foot step bearing. The coefficient of friction is equal to 0.05 and shaft carries a vertical load of 15 kN. 10

9. (a) Derive the centrifugal tension in the belt with the diagram. 10

- (b) An open - belt drive connects two pulleys 120 cm and 50 cm diameters, on parallel shafts 4 m apart.

The maximum tension in the belt is 1853.3 N. The co-efficient of friction is 0.3. The driver pulley of diameter 120 cm runs at 200 rpm. Calculate :

(i) The power transmitted

(ii) Torque on each of the two shafts.

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