

B. Mech. Engg. 2nd Yr 1st Sem Supple Exam 2017 (OLD)
KINEMATICS OF MACHINES (OLD)

Time: 3 Hrs

Full Marks: 100

(Assume data if missing)

(Answer Q. no. 1 and any 4 from the rest)

7. In a cam mechanism with a flat-faced translating follower, the total rise of the follower is 30 mm and the cam rotates through 180° during the rise period. During the first 90° of the cam rotation, the follower rises with constant acceleration and it decelerates uniformly during the second half of the rise period. The return of the follower is a simple harmonic motion during which the cam rotates through another 180° .

- If the minimum radius of curvature of the cam profile is not to be less than 40 mm during the rise, determine the minimum required radius of the base circle.
- Find out the minimum required width of the follower face with a 2.5 mm allowance on each side.
- What should be the minimum offset if the maximum eccentricity of the driving effort during the rise is not to exceed 15 mm?

20

8. Write short notes on:

- Toggle mechanism
- Paucellier mechanism
- Kutzback's criteria
- Instantaneous centre of rotation

5+5+5+5=20

- Choose the correct answer/s. (Attempt any twenty questions)
 - Quick return mechanism is an inversion of
 - Four bar chain
 - Single slider crank chain
 - Double slider crank chain
 - Crossed slider crank chain
 - In a full depth 14.5° involute system, the smallest number of teeth in a pinion which meshes with rack without interference is
 - 12
 - 16
 - 25
 - 32
 - Which of the following is an inversion of a double slider crank chain?
 - Whitworth quick return mechanism
 - Scotch yoke
 - Oldham's coupling
 - Rotary engine
 - 1 and 2
 - 1, 3 and 4
 - 2 and 3
 - 2, 3 and 4
 - Consider the following statement: coriolis component of acceleration depends on the
 - Velocity of the slider
 - Angular velocity of the link

- (3) Acceleration of the slider
 (4) Angular acceleration of the link
 (a) 1 and 2 are correct
 (b) 1 and 3 are correct
 (c) 2 and 4 are correct
 (d) 1 and 4 are correct
5. The gear train usually employed in clocks is a
 (a) Reverted gear train
 (b) Simple gear train
 (c) Sun and planet gear
 (d) Differential gear
6. An involute pinion and gear are in mesh. If both have the same size of addendum, then there will be an interference between the
 (a) Tip of the gear tooth and flank of the pinion
 (b) Tip of the pinion and flank of the gear
 (c) Flanks of both pinion and gear
 (d) Tips of both pinion and gear
7. The instantaneous centre of rotation of a rigid thin disc rolling on a plane rigid surface is located at
 (a) Centre of the disc
 (b) An infinite distance on the plane surface
 (c) The point of contact
 (d) The point on the circumference situated vertically opposite to the contact point
8. Which of the following is a higher pair?
 (a) Turning pair
 (b) Screw pair
 (c) Belt and pulley
 (d) Sliding pair
9. In spur gears, the circle on which the involute is generated is called
 (a) Pitch circle
 (b) Clearance circle

c) The end of contact

8+12=20

6. (a) Explain different types of gear train with sketches.
 (b) In the fig. 2, annulus A is rotating at 300 rpm about an axis of the fixed wheel S, which has 80 teeth. The three-armed spider is moving at 180 rpm. Determine the number of teeth required on the wheel P.

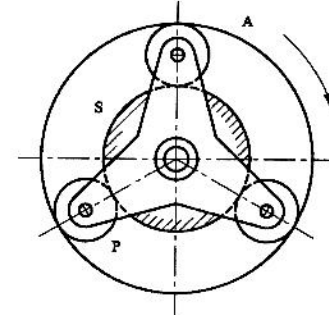


Fig. 2

- (c) In the fig. 3, for 3 turns of shaft D, find the number of turns of shaft F and the direction.

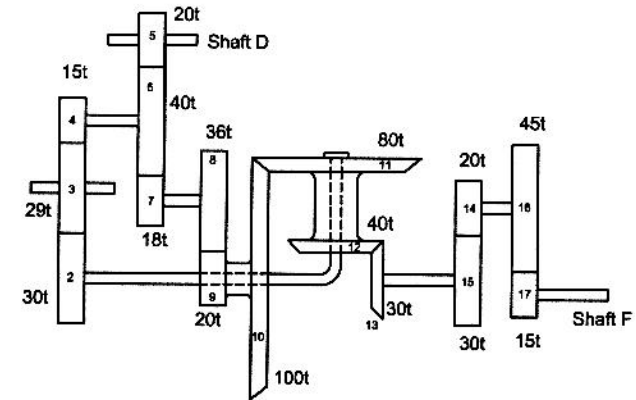


Fig. 3

6+6+8=20

14. Which gear train is used for higher velocity ratios in a small space?

- (a) Simple gear
- (b) Compound gear train
- (c) Reverted gear train
- (d) Epicyclic gear train

15. The number of Instantaneous centers in a mechanism is (where n is the number of links)

- (a) $n(n-1)/2$
- (b) $2n(n-1)/3$
- (c) $n(2n-1)/2$
- (d) $3n(n-1)/2$

16. Consider the following statements:

Coriolis acceleration component appears in the acceleration analysis of the following planar mechanisms:

1. Whitworth quick return mechanism
2. Slider crank mechanism
3. Scotch Yoke mechanism

Which of these statements is/are correct?

- (a) 1, 2 and 3
- (b) 1 and 2
- (c) 2 and 3
- (d) 1 only

17. Idler pulley is used for

- (a) Changing the direction of motion of the belt
- (b) Applying tension
- (c) Increasing -velocity ratio
- (d) All of the above

18. To obviate axial thrust, following gear drive is used

- (a) Double helical gears having opposite teeth
- (b) Double helical gears having identical teeth
- (c) Single helical gear in which one of the teeth of helix angle is more
- (d) Mutter gears

19. For S.H.M. cam, the acceleration of the follower at the ends of the stroke and at the mid stroke respectively, is

- (a) Maximum and zero
- (b) Zero and maximum
- (c) Minimum and maximum
- (d) Zero and minimum

20. Peaucellier mechanism has

- (a) Eight links
- (b) Six links
- (c) Four links
- (d) Twelve links

21. In its simplest form, a cam mechanism consists of following number of links

- (a) 1
- (b) 2
- (c) 3
- (d) 4

22. For simple harmonic motion of the of follower, a cosine curve represents

- (a) Displacement diagram
- (b) Velocity diagram
- (c) Acceleration diagram
- (d) All of the above

23. According to Kennedy's theorem, if three bodies have plane motions, their instantaneous centers lie on

- (a) A triangle
- (b) A point
- (c) Two lines
- (d) A straight line

1x20=20

2. The various dimensions of the mechanism, as shown in fig.1, 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.

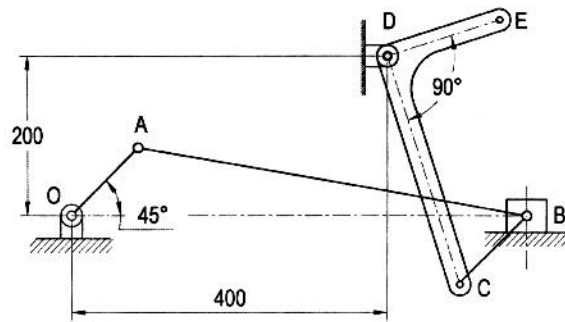


Fig. 1

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3. Show that the slider crank mechanism is a modification of the basic four bar mechanism.

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?

$$4+12+2+2=20$$

4. Explain Grashoff's criteria.

State and describe any two of the inversions of double slider crank mechanism with proper sketch.

$$6+14=20$$

5. State and derive the laws of gearing.

Two gears in mesh have a module of 8 mm and a pressure angle of 20° . The larger gear has 57 while the pinion has 23 teeth. If the addenda on the pinion and gear wheels are equal to 1.0 module, find

- The number of pairs of teeth in contact
- The angle of action of the pinion and the gear wheel
- The ratio of sliding to rolling velocity at
 - The beginning of contact
 - The pitch point

6

- Base circle
- Addendum circle

10. Which one of the following is correct?

- Davis steering mechanism has less friction due to turning pairs
- Ackermann gear mechanism uses only turning pairs
- Davis steering mechanism follows the fundamental equation of steering gear at all positions
- Ackermann gear mechanism follows the fundamental equation of steering gear at the middle and two end positions
 - 1 and 2
 - 2, 3 and 4
 - 1 and 3
 - 1 and 4

11. Transmission angle is the angle between

- Input link and coupler
- Input link and fixed link
- Output link and coupler
- Output link and fixed link

12. A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is

- 2
- 4
- 3
- None of the above

13. In which of the following type of gear train the first gear and the last gear are co-axial?

- Simple gear train
- Compound gear train
- Reverted gear train
- None of the above

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