Reg. No. : | | | | | | | | | | | |

Question Paper Code : P 1414

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fourth Semester

Mechanical Engineering

ME 1252 — KINEMATICS OF MACHINERY

(Common to Third Semester-Mechatronics Engineering)
(Also common to B.E. (Part-time) Third Semester Mechanical Engineering – Regulation 2005)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Sketches to be drawn neatly.

Give brief procedure for graphical constructions.

A3 size drawing sheet will be issued, if required.

Answer ALL questions.

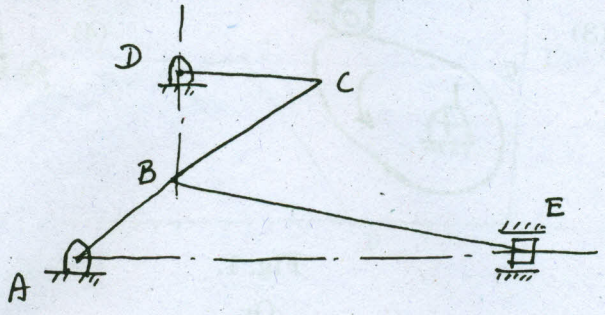
PART A — (10 × 2 = 20 marks)

1. What is Grashoff's law for a four bar linkage?

2. Sketch an offset slider crank mechanism.

3. How angular velocity of a link is calculated from a velocity diagram?

4. Write the name of the mechanism shown in figure.



5. In context with Cam, define Pitch point.

6. What is high speed cam?

7. What is interference in involute teeth?

8. Define velocity ratio of an epicyclic gear train.

9. What is friction angle?

10. State the condition for self locking of screw jack.

PART B — (5 × 16 = 80 marks)

11. (a) (i) In a whitworth quick return mechanism, driving crank is 15 cm long. The distance between the fixed centers is 10 cm. The line of stroke of ram passes through the center of rotation of slotted lever, whose free end is connected to the ram by a connecting link. Determine the ratio of time of cutting to time of return. (8)

(ii) Determine the number of degree of freedom of the following mechanisms, shown in the figure 1. (4 × 2 = 8)

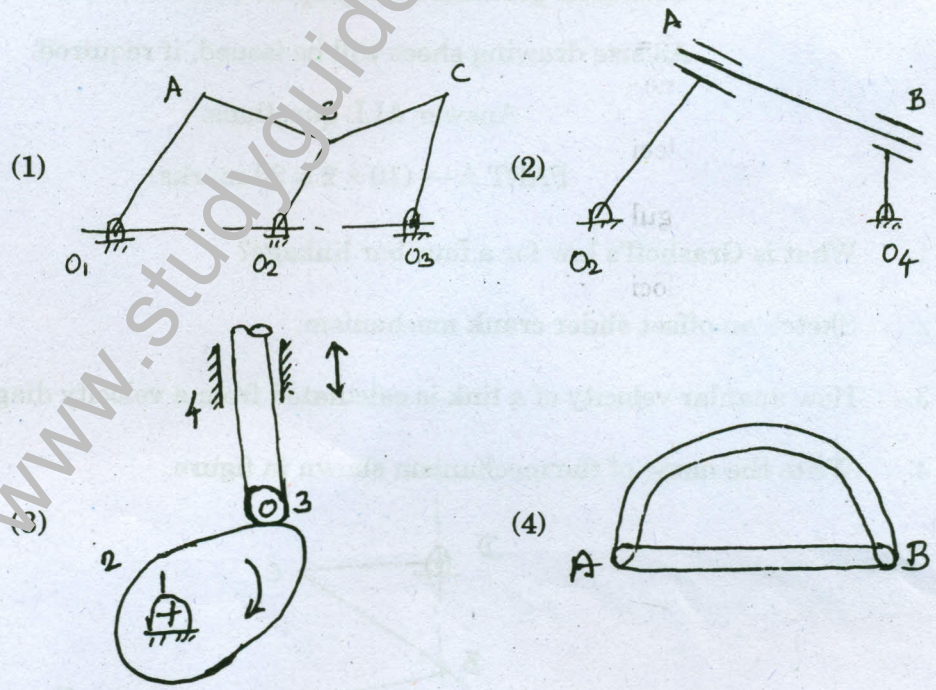


Fig. 1.

Or

(b) (i) Sketch the following straight line generators and show the path traced by the point. (2 × 4 = 8)

(1) Peaucillier mechanism

(2) Pantograph linkage.

(ii) Explain with sketches any two inversions of a double slider crank mechanism. (8)

12. (a) In a four bar linkage, link AD is fixed and crank AB rotates at 10 rad/sec constants. (clockwise). The lengths of various links are AB = 60 mm; AD = 120 mm; BC = CD = 70 mm; $\angle DAB = 60°$. Both B and C lie on the same side of AD. Determine.

(i) Angular velocities of link BC and CD

(ii) Angular accelerations of link BC and CD.

Or

(b) The dimensions of various links of a mechanism as shown in the figure 2 are as follows.

AB = 25 mm; BC = 175 mm; CD = 60 mm; AD = 150 mm; BE = $\left(\frac{3}{4}\right)$ EC; EF = FG = 100 mm; $\angle DAB = 135°$. The crank AB rotates at 200 rpm. Determine

(i) Velocity of G

(ii) Angular velocity of link EF

(iii) Velocity of sliding of EF in the swivel block S.

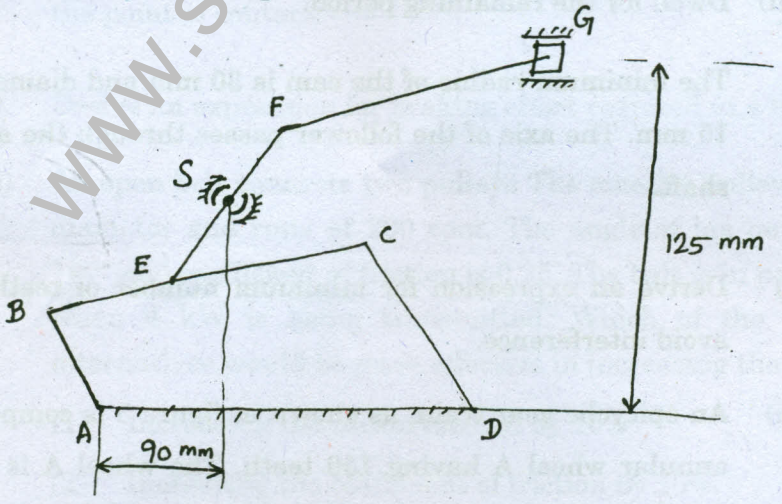


Fig. 2.

13. (a) (i) Sketch a plate cam mechanism with roller follower and mark. (8)

(1) Pitch curve

(2) Cam profile

(3) Base circle

(4) Prime circle

(5) Rise

(6) Return

(7) Dwell.

(ii) Derive equation of motion and its derivatives for a tangent cam with roller follower on straight surface. (8)

Or

(b) Draw the profile of cam when the follower moves with cycloidal motion for both out stroke and return stroke as detailed below.

(i) Outstroke with maximum displacement of 48 mm during 180° of cam rotation

(ii) Return stroke for the next 100° of cam rotation

(iii) Dwell for the remaining period.

The minimum radius of the cam is 30 mm and diameter of roller is 15 mm. The axis of the follower passes through the axis of the cam shaft.

14. (a) (i) Derive an expression for minimum number of teeth on pinion to avoid interference. (8)

(ii) An epicyclic gear train, as shown in figure 3 is composed of a fixed annular wheel A having 150 teeth. The wheel A is meshing with wheel B which drives wheel D through an idle wheel C, D being

concentric with A. The wheels B and C are carried on an arm which revolves clockwise at 100 rpm about the axis of A and D. If the wheels B and D have 25 and 40 teeth respectively, determine the number of teeth on C and speed and sense of rotation of wheel C. (8)

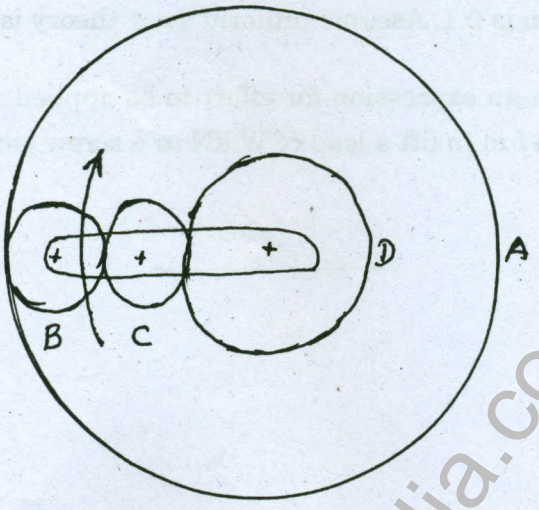


Fig. 3.

Or

(b) Two 20° involute spur gears mesh externally and gave a velocity ratio of 3.0. Module of both gears is 3 mm and the addendum is equal to one module. If the pinion rotates at 950 rpm, determine

(i) Minimum number of teeth on each wheel to avoid interference

(ii) Number of pair of teeth in contact

(iii) Maximum velocity of sliding at engagement, disengagement and at the point of contact.

15. (a) (i) Derive an expression for braking effort required in a band brake. (8)

(ii) An open belt connects two pulleys The smaller pulley is 300 mm in diameter and runs at 200 rpm. The angle of lap on this pulley is 160° and coefficient of friction is 0.25. The belt is in point of slipping when 4 kW is being transmitted. Which of the following two alternatives would be more effective in increasing the power rating?

(1) Increasing the initial tension by 10%

(2) Increasing the coefficient of friction by 10%. (8)

Or

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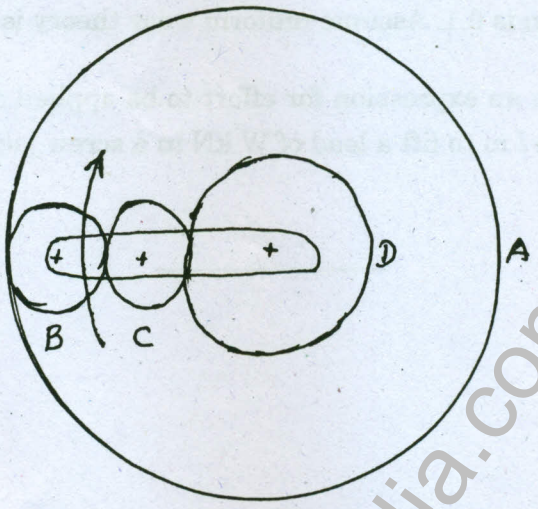

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(b) Two 20° involute spur gears mesh externally and gave a velocity ratio of 3.0. Module of both gears is 3 mm and the addendum is equal to one module. If the pinion rotates at 150 rpm, determine

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(ii) Number of pair of teeth in contact

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(1) Increasing the initial tension by 10%

(2) Increasing the coefficient of friction by 10%. (8)

Or

(b) (i) A multiple disc friction clutch operating in oil is required to transmit 5 kW at 760 rpm. The effective inner and outer radii of the friction surfaces are 40 mm and 70 mm respectively. Determine the minimum number of discs required, if the permissible average pressure for the friction surfaces is 0.35 MPa and coefficient of friction is 0.1. Assume uniform wear theory is applicable. (8)

(ii) Derive an expression for effort to be applied at the end of a lever of length l m to lift a load of W kN in a screw jack. (8)

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