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Question Paper Code : 60846

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Third Semester

Mechanical Engineering

ME 2203/ME 35/ME 1202 A/080120010/10122 ME 404 — KINEMATICS OF
MACHINERY

(Regulations 2008/2010)

(Common to PTME 2203/10122 ME 404 — Kinematics of Machinery for
B.E. (Part-Time) Third/Fourth Semester – Mechanical Engineering —
Regulations 2009/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is pressure angle? Why it should be kept small?
2. Define Backlash, Diametral pitch?
3. State the advantages of cam mechanisms over linkage mechanisms.
4. Briefly write about undercutting in cam.
5. Distinguish normal component of acceleration and tangential component of acceleration.
6. How will you determine the magnitude and direction of the Coriolis acceleration vector?
7. What is helix angle related to screws?
8. State the various types of friction clutches.
9. State and explain Mobility.
10. Write the effect of transmission angle on mechanical advantage.

PART B — (5 × 16 = 80 marks)

11. (a) Different mechanisms may be obtained by inverting the same kinematic chain. Explain the meaning of this statement with all inversions of Double slider crank chain. Give practical application of each inversion with suitable diagrams. (16)

Or

- (b) (i) Derive kutzbach criterion for motion in a plane and deduce Grubler's criterion (6)
- (ii) For the kinematic linkage shown in fig 11(b), find the following and give your comment on the following
- (1) the total number of binary, ternary and quaternary links (4)
 - (2) total number of links and joints (3)
 - (3) the number of mobility. (3)

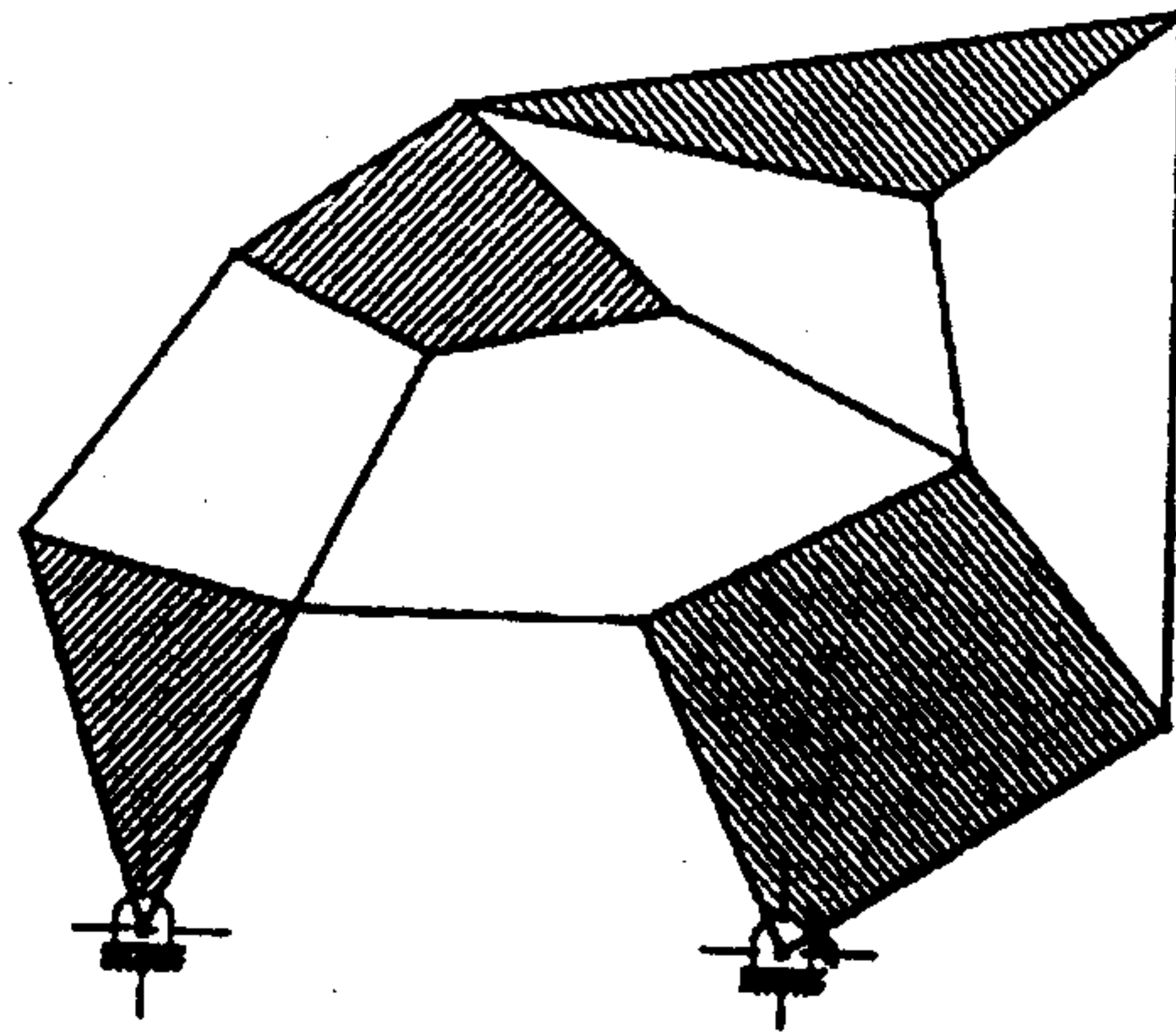


Fig. 11 (b)

12. (a) Draw the velocity diagram for the mechanism shown in the fig 12(a). Determine the velocity of the ram E for the given position, if crank OA rotates uniformly at 150 rpm.

OA = 150 mm, AB = 550 mm, BE = 350 mm, AC = 450 mm and DC = 500 mm. (16)

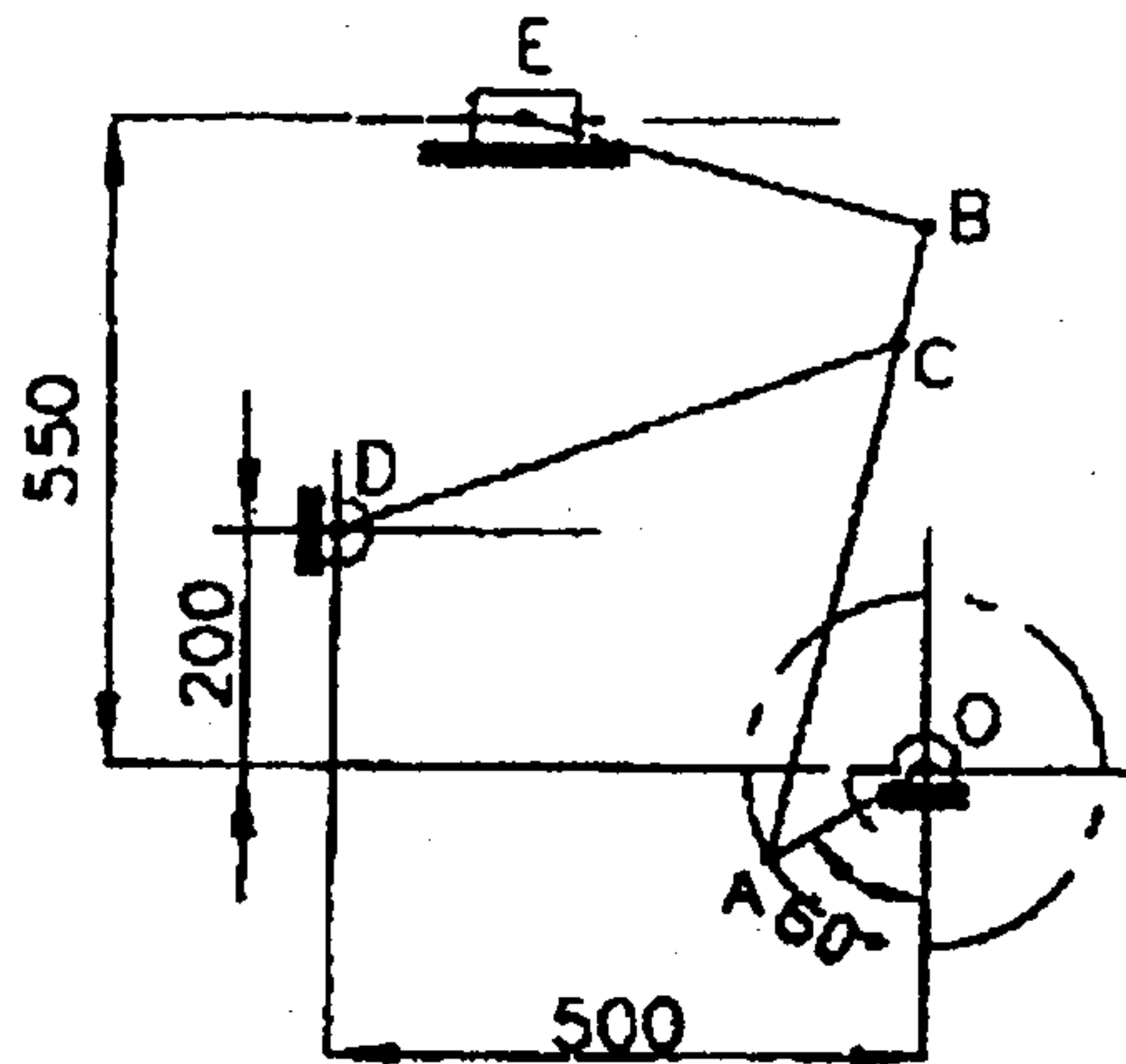


Fig. 12 (a)

Or

- (b) A link AB of a four bar linkage ABCD revolves uniformly at 120 rpm in a clockwise direction. Find the angular acceleration of links BC, CD and acceleration of point E in link BC.

Given: AB = 7.5 cm, BC = 17.5 cm, EC = 5 cm, CD = 15 cm, DA = 10 cm and $\angle BAD = 90^\circ$. (16)

13. (a) The following data relate to a cam profile in which the follower moves with cycloidal motion during the lift and returning it with uniform acceleration and deceleration, acceleration being half of the deceleration.

Minimum radius of cam = 30 mm.

Roller radius = 10 mm

Lift of the follower = 45 mm

Offset of the follower axis = 12 mm towards right

Angle of ascent = 70°

Angle of descent = 120°

Angle of dwell between ascent and descent = 45°

Speed of cam = 200 rpm

Draw the displacement velocity, acceleration diagram and cam profile. Also determine maximum velocity, maximum acceleration during lift and maximum velocity, maximum retardation during return. (16)

Or

- (b) The following data relate to a cam operating an oscillating roller follower:

Minimum radius of cam = 44 mm, diameter of roller = 14 mm, length of the follower arm = 40 mm, distance of fulcrum center from cam center = 50 mm, angle of ascent = 75° , angle of descent = 105° , angle of dwell for follower in the highest position = 60° , angle of oscillation of follower = 28° . Draw the profile the cam if the ascent and descent both take place with SHM. (16)

14. (a) An epicyclic gear train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on a star shaped planet carrier C. The size of different tooth wheels are such that the planet carrier C rotates at $1/5^{\text{th}}$ of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 Nm. Determine : (i) No. of teeth on different wheels of the train and (ii) Torque necessary to keep the internal gear stationary. (16)

Or

- (b) Two 20° involute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and the pinion 13 teeth. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? (16)

15. (a) A screw jack has a square thread, 7.5 cm mean diameter and 1.5 cm pitch. The load on jack revolves with the screw. The co-efficient of friction at the screw thread is 0.05. (i) Find the tangential force to be applied to the jack at 36 cm radius so as to lift a load of 600 N. (ii) State whether the jack is self locking. If it is, find the torque necessary to lower the load. If not, find the torque, which must be applied to keep the load from descending. (16)

Or

- (b) In a thrust bearing the external and internal radii of the contact surfaces are 210 mm and 160 mm respectively. The total axial load is 60 kN and $\mu = 0.05$. The shaft is rotating at 380 rpm. Intensity of pressure is not to exceed 350 kN/m². Calculate (i) power lost in overcoming the friction and (ii) number of collars required for the thrust bearing. (16)