B037415(037)

B. Tech. (Fourth Semester) Examination
April-May 2021

(Mechanical Engg. Branch)

KINEMATICS of MACHINES

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt all questions as directed. Part (a) of each question is compulsory. Neat and clean diagram will be give more weightage. Attempt questions of worth 20 marks from each unit.

Unit-I

1. (a) Classify kinematic pairs according to nature of relative motion.   4

    (b) An engine crankshaft drives a reciprocating pump through a mechanism as shown in figure. The crank

rotates in the clockwise direction at 160 rpm. The diameter of the pump piston at F is 200 mm. Dimension of the various links are :

$OA = 170$ mm (crank), $CD = 170$ mm, $AB = 660$ mm, $DE = 830$ mm, $BC = 510$ mm.

For the position of the crank shown in the diagram, determine the

(i) Velocity of the crank A and crosshead E

(ii) Velocity of DC

(iii) Velocity of rubbing at the pins, A, B, C and D, the diameters being 40, 30 30 and 50 mm respectively

(iv) Torque required at the shaft O to overcome a pressure of 300 kN/m² at the pump piston at F.

16
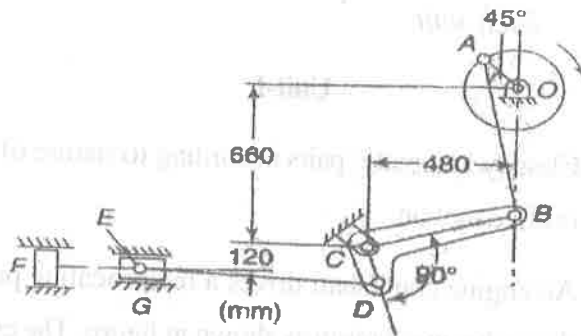
Or

(c) Explain single slider chain mechanism in detail with their inversions. Give suitable example of each inversion.   16
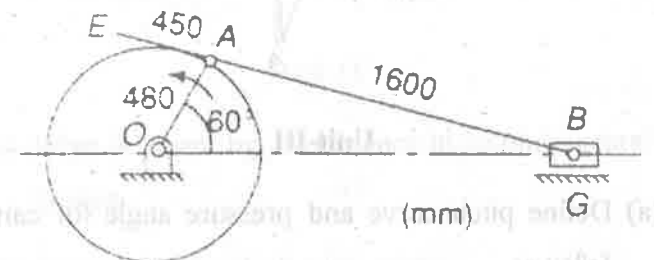
Unit-II

2. (a) Explain Coriolis acceleration component? In which cases does it occur? How is it determined?   4

(b) The configuration diagram of slider-crank mechanism shown in the figure.

Calculate the

(i) Acceleration of the slider at B

(ii) Acceleration of the point E

(iii) Angular acceleration of the link AB
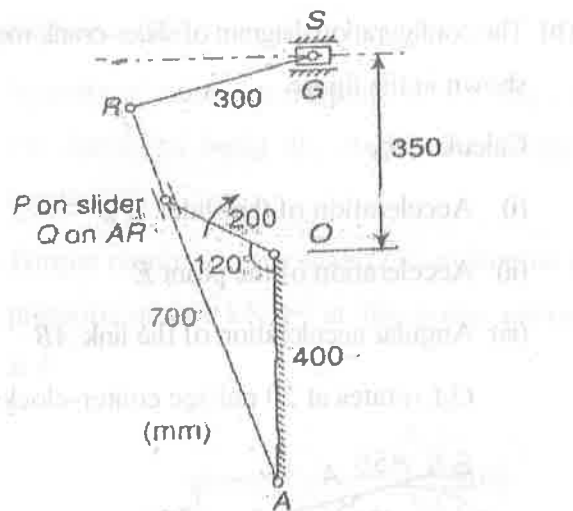
OA rotates at 20 rad/sec conter-clockwise.   16

Or

(c) Figure shows the link mechanism of a quick-return mechanism of the slotted-lever type, the various dimensions of which are $OA = 400$ mm, $OP = 200$ mm, $AR = 700$ mm, $RS = 300$ mm. For the configuration shown, determine the acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates at 210 rpm. 16

(mm)

Unit-III

3. (a) Define pitch curve and pressure angle for cam follower. 4

(b) Discuss tangent cam in detail. Find the expression for the velocity and acceleration of a roller follower for such a cam. 16

Or

(c) Draw the profile of a cam operating a roller reciprocating follower and with the following data :

Minimum radius of cam $= 25$ mm

Lift $= 30$ mm

Roller diameter $= 15$ mm

The cam lifts the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm, Calculate the maximum velocity and acceleration of the follower during the decent period. 16

Unit-IV

4. (a) What is meant by interference in involute gears? Explain. 4

(b) State and derive the law of gearing. 8

(c) Two 20° involute spur gear mesh externally and give a velocity ratio of 3. The module is 3 mm and the addendum is equal to 1·1 module. If the pinion rotates at 120 rpm. Determine the

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

    (ii) Contact ratio   8

(d) An epicyclic gear train consists of an arm and two gears A and B having 30 and 40 teeth respectively. The arm rotates about the centre of gear A at a speed of 80 rpm counter-clockwise. Determine the speed of gear B if (i) the gear A is fixed, and (ii) the gear A revolves at 240 rpm clockwise instead of being fixed.   8
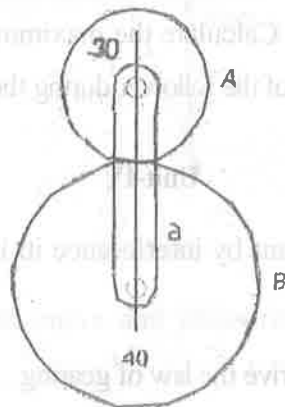
Unit-V

5. (a) Explain the following :   4

    (i) Idler pulley

    (ii) Intermediate pulleys

    (iii) Loose and fast pulleys

    (iv) Guide pulleys

(b) The force required just to move a body on a rough horizontal surface by pulling 320 N inclined at 30° and by pushing 380 N at the same angle. Find the weight of the body and the coefficient of friction.   8

(c) Derive the expression for length of the belt for open belt drive.   8

(d) A differential band brake has a drum with a diameter of 800 mm. The two ends of the band are fixed to the pins on the opposite sides of the fulcrum of the lever at the distances of 40 mm and 200 mm from the fulcrum. The angle of contact is 270° and the coefficient of the friction is 0·2. Determine the brake torque when a force of 600 N is applied to the lever at a distance of 800 mm from the fulcrum.   8