

Seat No.

[5668]-117**S.E. (Mech/Auto.) (Second Semester) EXAMINATION, 2019****THEORY OF MACHINES—I****(2015 PATTERN)****Time : Two Hours****Maximum Marks : 50****N.B. :— (i) Attempt Question Nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8.**

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) What is the condition for correct steering ? Distinguish between Ackerman steering gear and Davis steering gear with neat sketch. [5]
- (b) What are straight line mechanisms ? Describe Peaucellier exact straight line motion mechanism with the help of a sketch. [5]

Or

2. (a) Derive an expression for the correction torque to be applied to a crankshaft if the connecting rod of a reciprocating engine is replaced by two lumped masses at the piston pin and the crank pin respectively. [5]

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- (b) The length of a connecting rod of an engine is 500 mm measured between the centres and its mass is 18 kg. The centre of gravity is 125 mm from the crank pin centre and the crank radius is 100 mm. Determine the dynamically equivalent system keeping one mass at the small end. The frequency of oscillation of the rod, when suspended from the centre of the small end is 43 oscillations per minute. [5]

3. (a) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm². Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. [7]
- (b) Which of the two assumptions-uniform intensity of pressure or uniform rate of wear would you make use of in designing friction clutch and why ? [3]

Or

4. (a) Two inclined shafts are connected by means of a universal joint. The speed of the driving shaft is 1000 r.p.m. If the total fluctuation of speed of the driven shaft is not to exceed 12.5% of this, what is the maximum possible inclination between the two shafts ? Also find the angles of shaft rotation at which the driving and driven shaft are same ? [5]
- (b) How are velocity and acceleration of the slider of a single slider crank chain determined analytically ? Derive it. [5]

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5. (a) Discuss the three types of instantaneous centre of rotation of mechanism. [3]
- (b) Figure 1 shows a sewing needle bar mechanism O_1ABO_2CD wherein the different dimensions are as follows. Crank $O_1A = 16$ mm; Angle $\beta(\text{beta}) = 45^\circ$; Vertical distance between O_1 and $O_2 = 40$ mm, horizontal distance between O_1 and $O_2 = 13$ mm, $O_2B = 23$ mm, $AB = 35$ mm. Angle $O_2BC = 90^\circ$. $BC = 16$ mm, $CD = 40$ mm. D lies vertically below O_1 . Find the velocity of the needle D for the given configuration using ICR method when Crank O_1A rotates at 400 rpm. [12]

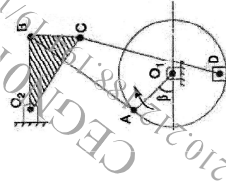


Fig. 1

Or

6. (a) Explain acceleration image principle with neat sketch. [3]
- (b) In the mechanism shown in figure 2, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s^2 . The dimensions of various links are $AB = 3$ m inclined

at 45° with the vertical and $BC = 1.5$ m inclined at 45° with the horizontal. Determine :

1. The magnitude of vertical and horizontal component of the acceleration of the point B, and
2. The angular acceleration of the links AB. [12]

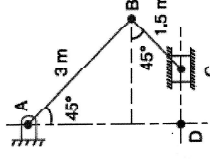


Fig. 2

7. (a) A mechanism of crank and slotted lever quick return motion is shown in figure 3. If the crank rotates counter clockwise at 120 rpm. Determine for the given configuration the velocity and acceleration of the ram D. Also determine angular acceleration of the slotted lever. [12]

Crank $AB = 150$ mm, Slotted Arm, $OC = 700$ mm and link $CD = 200$ mm.

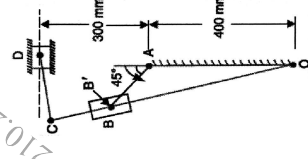


Fig. 3.

- (b) Explain Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism, for uniform angular velocity [3]

Or

8. (a) Explain Coriolis component of acceleration with neat sketch. [5]
(b) The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm respectively. The crank is rotating in clockwise direction at 120 rad/s. Find with the help of Klein's construction :

1. Velocity and acceleration of the piston,
2. Velocity and acceleration of the midpoint of the connecting rod, and
3. Angular velocity and angular acceleration of the connecting rod, at the instant when the crank is at 30° to I.D.C. (inner dead centre). [10]