Total No. of Questions—**8**] [Total No. of Printed Pages—**5**

Seat No.	

[5459]-115

S.E. (Mech./Auto.) (Second Semester) EXAMINATION, 2018

THEORY OF MACHINES—I

(2015 PATTERN)

Time : 2 Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6**, Q. **7** *or* Q. **8**.

(*ii*) Neat diagrams must be drawn whenever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data whenever necessary.

1. (*a*) Sketch and explain inversions of slider crank mechanism. [5]

(*b*) Derive equation for correct steering in a steering gear mechanism. [5]

Or

2. (*a*) Identify Friction circle in a Journal bearing with the help of a neat sketch. [5]

(*b*) A vertical engine running at 1200 rpm. With a stroke of 110 mm has a connecting rod 250 mm between centres and mass of 1.25 kg. The mass centre connecting rod is 75 mm from big end centre and when suspended as a pendulum from the gudgeon pin axis makes 21 oscillations in 20 seconds. Calculate the radius of gyration of the connecting rod about an axis through its mass centre. [5]

3. (*a*) Describe with neat sketch the construction and working of Epicyclic train type dynamometer. [4]

(*b*) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 rpm. Determine the outer and inner radii of friction surface if the coefficient of friction is 0.25, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. [6]

Or

4. (*a*) Two shafts are connected by a Hook's joint. The driving shaft rotates uniformly at 500 rpm. If the total permissible variation of speed of the driven shaft not to exceed 6% of the mean speed, find the greatest possible angle between the center line of shafts. Also determine maximum and minimum speed of the driven shaft. [6]

(*b*) Write a loop closure equation for slider crank mechanism. [4]

5. (*a*) Locate all the instantaneous centers of the mechanism as shown in fig. 1. The length of links are AB = 150 mm, BC = 300 mm, CD = 225 mm and CE = 500 mm. when the crank AB rotates in the anticlockwise direction at a uniform speed of 240 rpm : [10]

Find :

(*i*) Velocity of slider E

(*ii*) Angular velocity of link BC and CE.

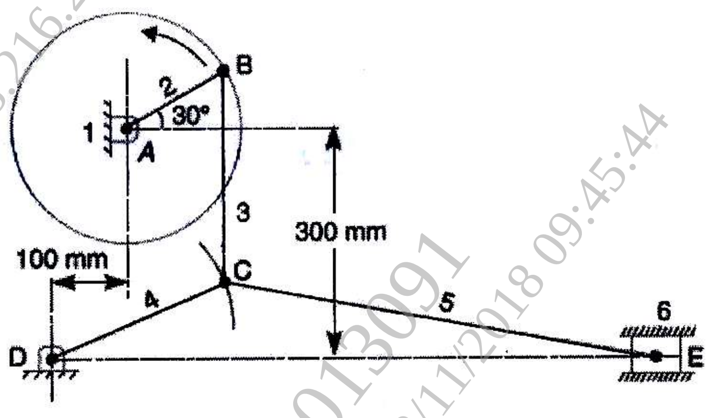

Fig. 1

(*b*) Explain Space and Body Centrode. [5]

Or

6. (*a*) The crank of slider crank mechanism shown in Fig. 2 rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and connecting rod is 600 mm long. [10]

Determine :

(*i*) Linear velocity and acceleration of the midpoint of the connecting rod.

(*ii*) Angular velocity and angular acceleration of the connecting rod at a crank angle of 45º form IDC. Solve using relative velocity and acceleration method.

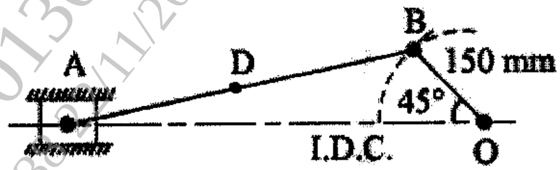

Fig. 2

(*b*) Discuss Kennedy's theorem for locating ICR. [5]

7. The driving crank AB of the quick return mechanism as shown in Fig. 3, rotates at a uniform speed of 200 rpm. Find the velocity and acceleration of the point Q in the position shown, when the crank makes an angle of 60º with the vertical line AP. What is the acceleration of sliding of the block at B along the slotted lever PQ ? [15]

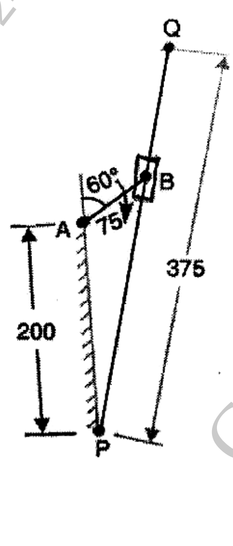

Fig. 3

Or

8. (*a*) The crank of a reciprocating engine is rotating in clockwise direction with a constant angular velocity of 60 rad/s, the lengths of crank and connecting rod are 100 mm and 350 mm respectively. Using Klien's construction, find : [12]

1. Velocity and acceleration of piston
2. Angular velocity and angular acceleration of connecting rod.
3. Velocity and acceleration of midpoint of connecting rod,

when the crank has turned through 30° from inner dead center.

(*b*) Discuss all four cases to determine direction of Coriolis component of acceleration when a block is sliding on rotating link. [3]