Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

Seat No.	

[4957]-1016

S.E. (Mech./Mech. Sand./Auto.) (Second Semester)

EXAMINATION, 2016

THEORY OF MACHINES–I

(2012 PATTERN)

Time : Two 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 wherever necessary.

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

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data if necessary.

1. (*a*) Fill in the blanks with *correct* alternative and rewrite the complete sentences : [5]

(*i*) In a double slider four bar kinematic chain, if the link connecting two sliders is grounded, we get ..... .

(*a*) Elliptical Trammel (*b*) Scotch-Yoke Mechanism

(*c*) Oldham's coupling (*d*) Crank rocker mechanism

(*ii*) A hinged door and wall form a.....pair.

(*a*) Prismatic (*b*) Cylindrical

(*c*) Spherical (*d*) Revolute

P.T.O.

(*iii*) Number of pairs associated with Quaternary Joint is..... .

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

(*iv*) We can get.....Mechanism/s from double slider kinematic chain.

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

(*v*) Oscillating cylinder mechanism is obtained when.....is grounded.

(*a*) Connecting rod (*b*) Piston

(*c*) Cylinder (*d*) Crank

(*b*) Figure 1 shows schematic of mechanism. Redraw the sketch on the answer book. Find out the total number of kinematic links and number of kinematic pairs. Hence find out the degrees of freedom for the mechanism. [5]

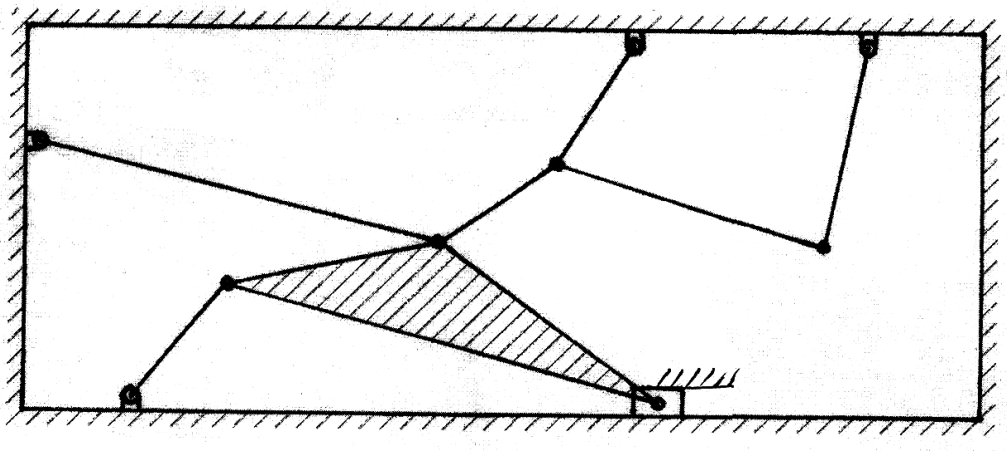


Fig. 1

Or

2. (*a*) Two columns are given below. Copy the first column on your answer paper and match the pairs by writing down most appropriate choice from column II in front of the elements from column I : [5]

Column I	**Column II**
1. Moment of inertia of flywheel	Crankshaft torque positive
2. Power stroke	Bifilar Suspension
3. Friction between balls and races in bearings	Crankshaft torque negative
4. Dynamically equivalent system	Dry friction
5. Piston moves from ODC to IDC	Trifilar Suspension
	Compound pendulum
	Greasy Friction

(*b*) Write a short note on 'Laws of Friction'. [5]

3. (*a*) Rewrite the following sentences and state whether they are true or false. In case if they are false, rewrite the corrected sentence with justification : [5]

(*i*) Torque lost in collar friction is more if the number of supporting collars is more.

(*ii*) Torque transmission capacity of multi plate clutch is always more than that of single plate clutch.

(*iii*) Two wheeler vehicles have multi-plate clutches installed in the transmission system.

(*iv*) Wheels of railway wagon are equipped with internal shoe brakes.

(*v*) Epicyclic gear dynamometer is transmission type dynamometer.

(*b*) Explain Vector Algebra method of velocity analysis for a binary link. [5]

Or

4. (*a*) Explain the construction and working of 'Differential Band Brake' and state the conditions of self-locking and self-energizing. [6]

(*b*) Compare Single Hookes Joint with Double Hookes Joint. [4]

5. (*a*) Explain the significance of 'Body Centrode' and 'Space Centrode'. [5]

(*b*) In the mechanism shown in Fig. 2, the crank OA rotates at 60 rpm in clockwise direction and gives motion to the sliding block B and oscillating link PD. For the given configuration of mechanism, determine by relative velocity method and relative acceleration method : [10]

(*i*) Velocity of slider B

(*ii*) Angular velocity of link PD

(*iii*) Acceleration of slider B.

Assume : OA = 40mm, Extension AC = 20mm, AB = 100mm, CD = PD = 35mm.

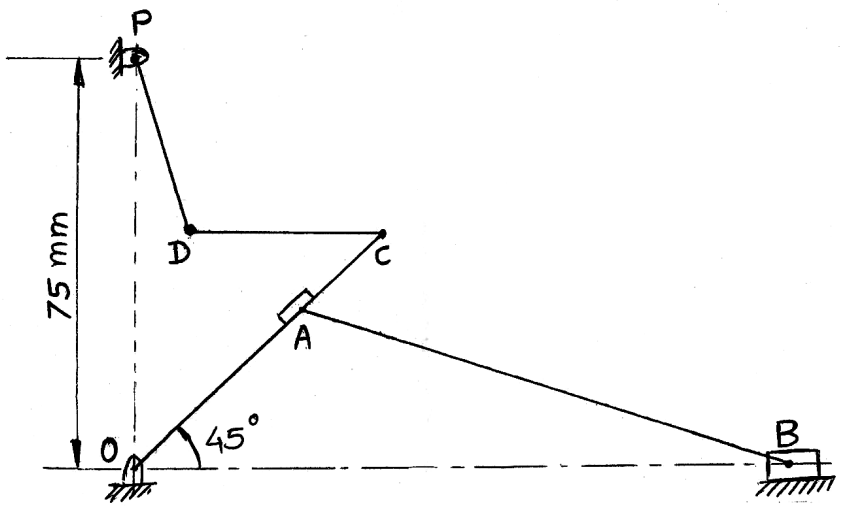


Fig. 2 [For Q. 5 (*b*) and Q. 6(*b*)]

Or

6. (*a*) Justify the statement 'If relative velocity between two points on a rigid ling exists, it must be directed along a line perpendicular to the line joining those two points'. [5]

(*b*) In the mechanism shown in Fig. 2, the crank OA rotates at 60 rpm in anticlockwise direction and gives motion to the sliding block B and oscillating link PD. For the given configuration of mechanism, determine by ICR method : [10]

(*i*) Velocity of slider B

(*ii*) Angular velocity of link PD

(*iii*) Angular velocity of link CD (Locate only those ICRs which are necessary for analysis)

Assume : OA = 40mm, Extension AC = 20mm, AB = 100mm, CD = PD = 35mm.

7. (*a*) A large circular disc of radius 2m is pivoted at centre 'C' and is rotating anticlockwise with uniform angular velocity 2 rad/s, in the horizontal plane. A man, initially standing at centre 'C' of the rotating disc, starts walking radially outwards along the radius CP, with velocity of 250mm/s. Find out the magnitude and direction of the 'Coriolis component' of relative acceleration of the walking man with respect to the rotating disc, at the instant when the radial line CP (along which the man is walking) is perfectly oriented due East. [5]

(*b*) The crank of an engine is 150 mm long and obliquity ratio is 3. Determine the velocity and acceleration of the piston when the crank is turned through 45º from I.D.C. position for the following two cases by using Klein's construction method : [10]

(*i*) The crank rotates at a uniform speed of 200 rpm.

(*ii*) The crank rotates at a speed of 200 rpm and is increasing at the rate of 100 rad/s^2.

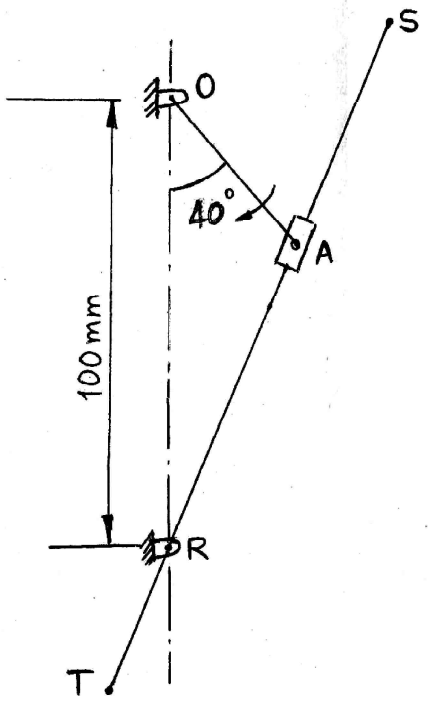
Or

8. (*a*) We know that 'Klein's Velocity Polygon' and 'Klein's Acceleration polygon' must be rotated and scaled with respect to the given configuration diagram of the slider crank mechanism so that the conclusions regarding magnitude and direction of different vectors can be drawn. Compare these two 'Klein's' polygons based on the following points : [4]

(*i*) Angular orientation with respect to configuration diagram.

(*ii*) Scaling factor with respect to the configuration diagram.

(*b*) In the mechanism shown in Fig. 3, the crank OA rotates at 120 rpm in clockwise direction and transmits motion to the oscillator RS, pivoted at R. If RT is backward extension of Link RS find out instantaneous acceleration of point T. [11]



OA = 45 mm

RS = 150 mm

RT = 35 mm

Fig. 3