Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4857]-1016

S.E. (Mechanical/Automobile Engg./Mech.-SW) (Second Semester)

EXAMINATION, 2015

THEORY OF MACHINES—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2,** Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

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

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

(*iv*) Use of non-programmable calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Find the mobility (degrees of freedom) of the mechanism shown in Fig. 1. [4]

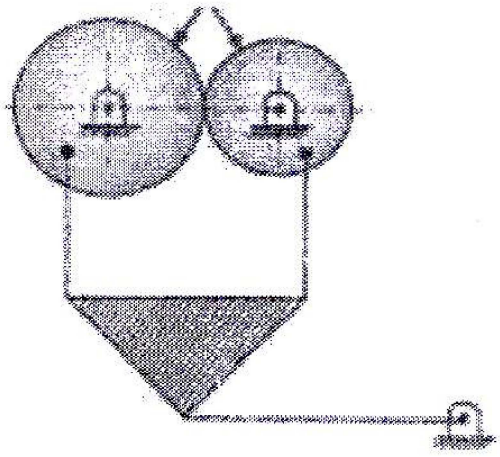


Fig. 1

P.T.O.

(*b*) A disc like machine component of 7 kg mass is placed on a horizontal platform, which is suspended by three equal wires, each 1 m long, from a rigid support. The wires are equally spaced round the circumference of a circle with 200 mm diameter. When mass centre of the component coincides with the rotational axis of the platform, it takes 30 sec. for 10 oscillations. The platform alone has mass of 2 kg and takes 40 sec. for 10 oscillations. Find moment of inertia of machine components as well as its radius of gyration about the axis through its mass centre. [6]

Or

2. (*a*) What is the condition for correct steering ? Explain with neat sketch Ackermann steering gear mechanism. [6]

(*b*) What is meant by correction couple ? When do we need to consider it ? [4]

3. (*a*) An automobile single plate clutch consists of a pair of contacting surfaces. The inner and outer radii of friction plate are 120 mm and 250 mm respectively. Coefficient of friction is 0.25 and the total axial force is 20 kN. Calculate the power transmitting capacity of the clutch at 600 rpm by using :

(*i*) Uniform wear theory

(*ii*) Uniform pressure theory. [6]

(*b*) Comment on statement "Cone clutches provide high frictional torque but they have become obsolete". [4]

Or

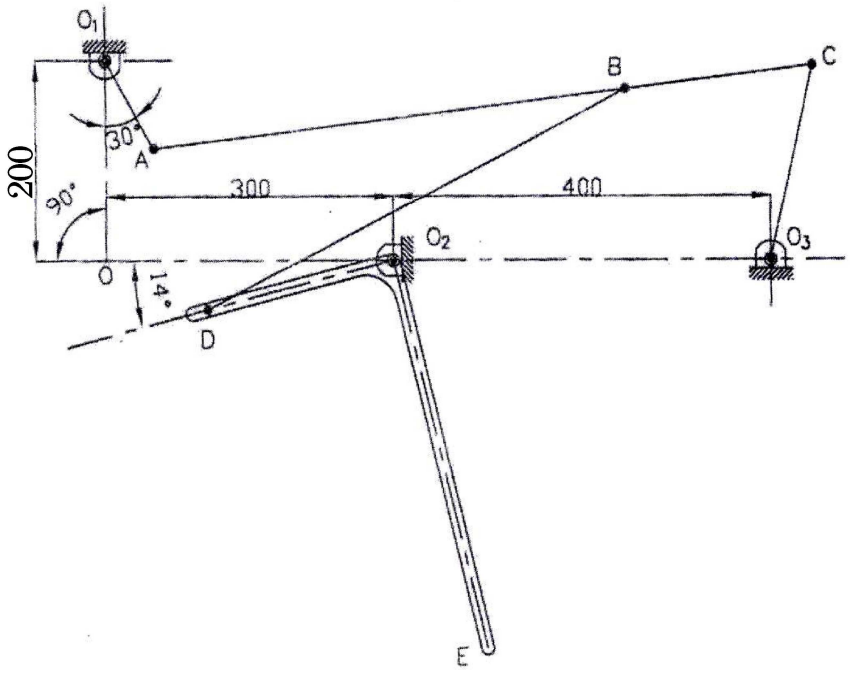
4. (*a*) Two shafts, angle between whose axis is 15° are connected by a Hooke's joint. Find the angle turned through by the driving shaft rotates when :

(*i*) V.R. is maximum, minimum and unity

(*ii*) Hence, or otherwise, draw the polar diagram representing angular velocities of driving and driven shafts indicating the various angular positions calculated above. [6]

(*b*) The following data refers to a laboratory experiment with rope break. Diameter of the flywheel = 1 m, Diameter of rope = 12 mm, Dead weight on the brake = 55 kg, Speed of the engine = 200 rpm, Spring balance reading = 130 N. Find the brake power of the engine. [4]

5. (*a*) In the mechanism shown in the Fig. 2, the crank O_1A rotates with uniform speed of 100 rad/sec in clockwise direction. Draw the mechanism and find out the length BD. Find the position of instantaneous centre between crank O_1A and the bell crank lever DO_2E. Hence or otherwise, find the velocity of the point D. [12]



Q_1A = 100 mm
OO_1A = 30°
Q_1O = 200 mm
O_1OO_2 = 90°
AC = 700 mm
OO_2 = 300 mm
O_2O_3 = 400 mm
O_3C = 200 mm
BC = 200 mm
OOD = 14°
O_2D = 200 mm
O_2E = 400 mm

Fig. 2

(*b*) Explain the concept of rubbing velocity at pin joint. [3]

Or

6. (*a*) Fig. 3 shows part of an opposed piston engine mechanism. The velocity of the piston E for the given instant is 780 mm/s. The crank 'OA' rotates at uniform speed in clockwise direction and makes an angle of 45° to the vertical as shown in Fig. 3. Draw velocity and acceleration diagram and determine :

(*i*) The speed of crank in rpm

(*ii*) Angular velocity of link BCD

(*iii*) Angular acceleration of link BCD

(*iv*) Acceleration of piston E. [12]

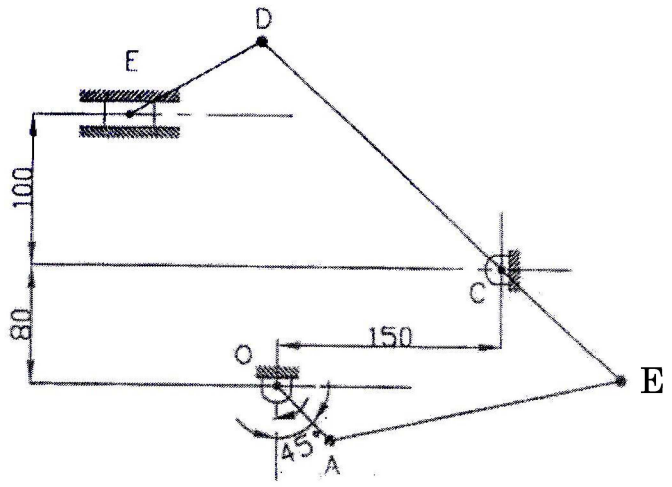


Fig. 3

(*b*) State and explain Aranhold Kennedy's three centre inline theorem. [3]

7. (*a*) In the swiveling joint mechanism shown in Fig. 4. AB is the driving crank rotating at 300 rpm clockwise. The lengths of various links are AD = 650 mm, AB = 100 mm, OF = 240 mm, BC = 800 mm, FS = 400 mm, DC = 250 mm, BE = CE. For the given configuration of the mechanism determine the acceleration of sliding of the link EF in the trunnion. [11]

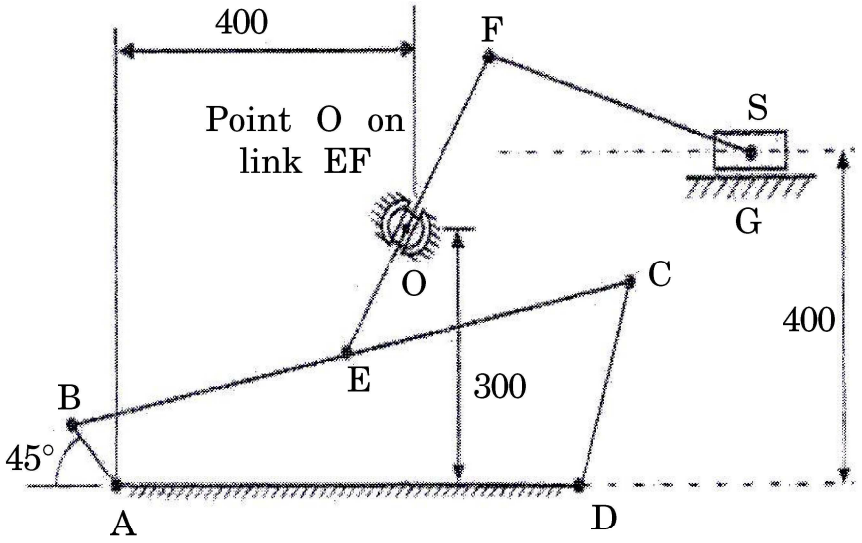


Fig. 4

(*b*) Draw Klein's construction for determining the acceleration of the piston of a reciprocating engine, when the crank is rotating with non-uniform angular velocity. [4]

Or

8. (*a*) The crank of an engine is 200 mm long and the ratio of connecting rod length to the crank radius is 4. Determine the acceleration

of the piston, the acceleration of a point X on the connecting rod (located at 3/4th distance from small end) and the angular acceleration of the connecting rod when the crank is turned through 45° from the IDC position for the following cases :

(*i*) When the crank rotates at a uniform speed of 240 rpm clockwise.

(*ii*) When the instantaneous speed of rotation of the crank is 240 rpm clockwise and is increasing at the rate of 100 rad/sec^2. Use Klein's construction. [11]

(*b*) Derive an expression for magnitude of Coriolis component of acceleration. [4]