Total No. of Questions—8]   [Total No. of Printed Pages—3

Seat No.	

[5559]-115

S.E. (Mech./Autom.) (Second Semester) EXAMINATION, 2019
THEORY OF MACHINES—I
(2015 PATTERN)

Time : 2 Hours   Maximum Marks : 50

Instructions to the candidates:
1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Calculator is allowed.*
5) *Assume Suitable data if necessary.*

1 a) What do you understand by inversion of a kinematic chain? Explain with the help of   [06]
       neat sketches any one inversion of a double slider crank chain, giving their practical
       applications.

   b) Redraw the mechanism as shown in fig. and determine types and number of pairs, links   [04]
   and degree of freedom.
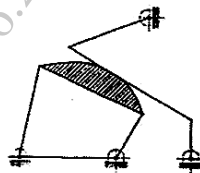
OR

2 a) With the help of neat schematic diagram derive frequency equation of Bifilar   [05]
       suspension method.

   b) A connecting rod of petrol engine has mass of 2 Kg and the distance between the   [05]
       centre of gudgeon pin and centre of crank pin is 250 mm. the C. G. falls at a point 100
       mm from the crank pin centre. The radius of gyration about an axis through C. G.
       perpendicular to the plane of rotation is 110 mm. Find the equivalent kinetically system
       if one of the mass is located at the gudgeon pin.

P.T.O.

. 3 a) Explain construction and working of Tatham Dynamometer with neat sketch. [04]

b) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semi-cone angle is 20° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed 0.25 N/mm2, find the dimensions of the conical bearing surface and the axial load required. [06]

OR

Q. 4 a) For an I.C. engine mechanism, the crank radius is 90 mm and connecting rod length is 450 mm. The crank is rotating in clockwise direction with angular velocity of 15 rad / sec. and the angular acceleration of 100 rad / sec^2. Using complex number method, find the acceleration of the piston and angular acceleration of the connecting rod when the crank is at 60° from the inner dead centre. [05]

b) A single hook's joint is to connect two shaft. The driving shaft operates at a uniform speed of 1500 rpm. Find the greatest permissible angle between the shafts so that fluctuation of shaft may not exceed 200 rpm. Also find maximum and minimum speed of output shaft. [05]

Q. 5 a) Explain with neat sketch; 1. Space centrode, 2. Body centrode. [03]

b) A Four-bar mechanism with ternary link is shown in fig. The link lengths are O_1O_2 = 600 mm, O_1A = 300 mm, AB = 400 mm, O_2B = 450 mm, AC = 300 mm. Determine velocity & acceleration of coupler AB. Using relative velocity method, when angular velocity of link O_1A = 20 rad/s & angular acceleration of link O_1A = 100 rad / S^2 l(BC) = 200 mm [12]
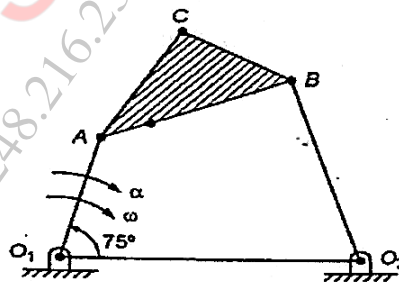

OR

Q. 6 a) Explain with the help of neat sketch velocity image principal. [03]

b) Following figure shows a mechanism in which the driving crank OA rotates in the clockwise direction at a constant speed of 225rpm. Link AB drives the link CD through a pin joint at B. Block C is free to slide in a fixed curved slot, the center of which is at O_1. Determine for the configuration shown the magnitude and direction of (i) velocity of slider D, (ii) angular velocity of AB [12]
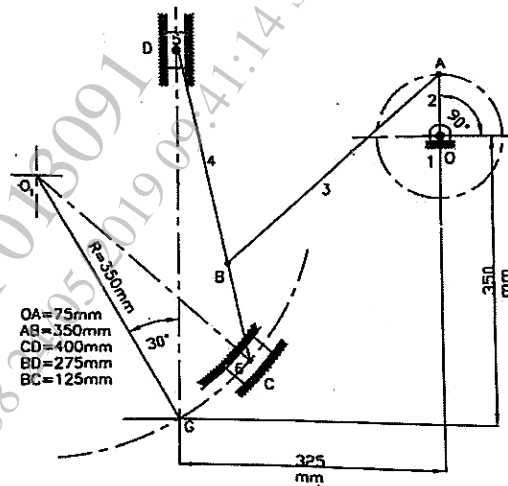
Q.7.a) Explain construction of velocity polygon by using Kleins construction when the crank rotates with uniform angular velocity. [3]

b) A quick return mechanism is shown in fig. Link OA rotates at 20 rad/s. Draw the velocity and acceleration diagram using relative velocity and acceleration method. Link lengths are OA = 150 mm, BC = 250 mm & OC = 350 mm. Find angular velocity of link BC and Coriolis acceleration. [12]
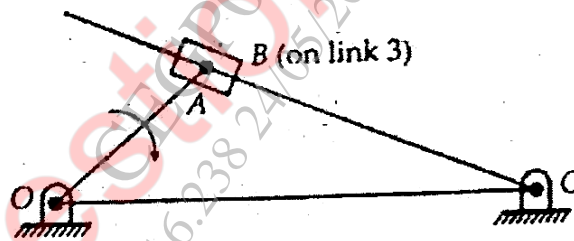
OR

Q. 8 a) Explain the procedure to decide direction of coriolis component of acceleration with neat sketch. [03]

b) The following data relate to a slider crank mechanism. Crank radius = 150 mm, connecting rod length = 650 mm, crankshaft speed = 240 mm. Find the following at the instant when the slider has zero acceleration by using Klein's construction, the velocity & acceleration of the mid - point of connecting rod. [06]

c) The crank of reciprocating engine is 180 mm long, the connecting rod is 720 mm long. When the crank has turned through 40° from inner dead centre, it has an instantaneous speed of 300 rpm clockwise, increasing at the rate of 120 rad / s². Find the following using Klein's construction, The velocity and acceleration of piston. [06]