

[5152]-517

**S.E. (Mechanical/Automobile) (Semester - II)**

**THEORY OF MACHINES - I**

**(2015 Pattern)**

*Time : 2 Hours]*

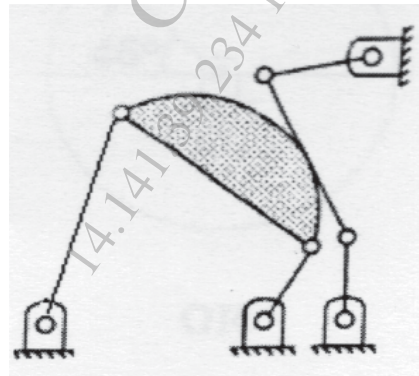
*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer Q. 1 or Q.2, Q. 3 or Q.4, Q. 5 or Q.6, Q. 7 or Q.8.
- 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.

**Q1) a)** What do you understand by inversion of a kinematic chain? Explain with the help of neat sketches any one inversion of a double slider crank chain, giving their practical applications. [6]

b) Find degrees of freedom for the mechanism as shown in the following fig. [4]



OR

**Q2) a)** With the help of neat schematic diagram derive frequency equation of Bifilar Suspension method. [5]

b) The connecting rod of an engine weighing 12 Kg is 500 mm long. The obliquity ratio is 5 and the C.G. of connecting rod is at the distance

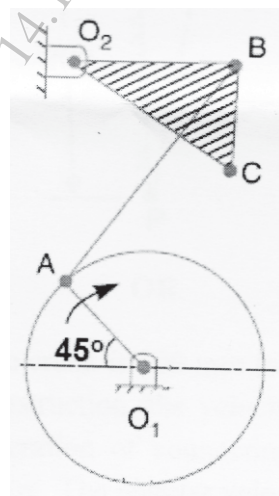
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of 120 mm from the crank pin centre. The periodic time of oscillation for the connecting rod when suspended from centre of small end is 1.33 sec. Determine dynamically equivalent two mass systems keeping one mass at small end. [5]

- Q3) a)** Explain construction and working of Tatham Dynamometer with neat sketch. [4]
- b)** A conical clutch has a cone angle of  $30^\circ$ , if the maximum intensity of pressure between the contact surfaces is limited to 70 KPa and the width of conical surface is not to exceed one third of the mean radius find the dimensions of the contact surfaces to transmit 22 KW at 2000 rpm assuming uniform wear theory and take coefficient of friction as 0.15. [6]

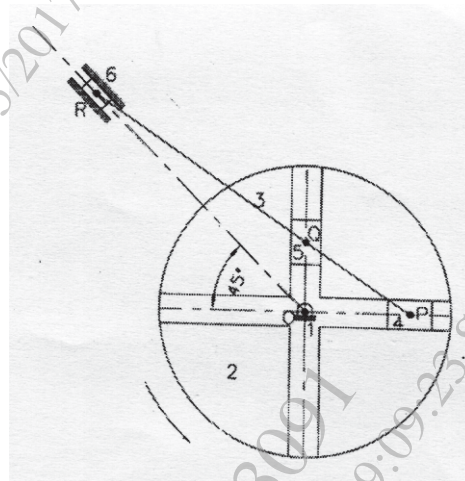
OR

- Q4) a)** Derive an Equation for finding velocity and acceleration of slider using analytical method. [5]
- b)** A universal joint is used to connect two shafts which are inclined at  $20^\circ$  and the speed of the driving shaft is 1000 rpm. Find the extreme angular velocities of the driven shaft and its maximum angular acceleration. [5]
- Q5) a)** Explain with neat sketch Acceleration Image Principle. [3]
- b)** Fig. shows a mechanism wherein the different dimensions are as follows: Crank  $O_1A = 160$  mm; Vertical distance between  $O_1$  and  $O_2 = 400$  mm; Horizontal distance between  $O_1$  and  $O_2 = 130$  mm;  $O_2B = 230$  mm;  $AB = 350$  mm;  $\angle O_2BC = 90^\circ$ ;  $BC = 160$  mm. Find the velocity and acceleration of C, angular velocity and angular acceleration of link  $O_2BC$  for the given configuration. The crank  $O_1A$  rotates at 400 r.p.m. [12]

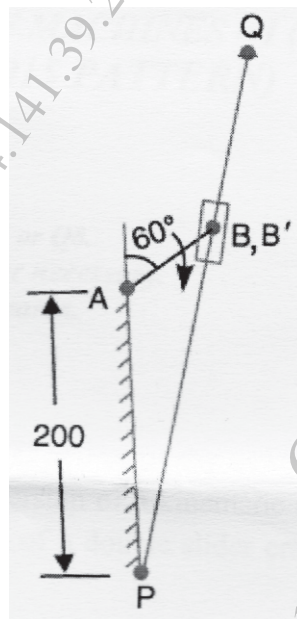


OR

- Q6)** a) Explain with the help of neat sketch different type of ICR's. [3]  
 b) A slotted link labeled 2 shown in the following fig. rotates in anticlockwise direction at 1200 rpm. Blocks 4 and 5 slides in the slot in link 2. The slots are at right angles. Block 6 slides in a fixed slot as indicated. A straight rigid rod, labeled 3, is pinned to the blocks at P, Q and R.  $OP = 165$  mm,  $PR = 600$  mm. Determine the velocity of Slider R using theorem of three centre in line. [12]



- Q7)** a) Derive an expression for Magnitude of corioli's component of acceleration. [3]  
 b) In the mechanism shown in the fig., link AB rotates at 200 rpm uniformly in clockwise direction. The various dimensions are  $AB = 75$  mm and  $PQ = 375$  mm. Find velocity and acceleration of Q, using relative velocity & acceleration method. [12]



OR

- Q8) a)** In an I C Engine mechanism, the crank is 200 mm long and connecting rod is 800 mm long. Find by using Klein's construction, the velocity and acceleration of piston and angular velocity, angular acceleration of connecting rod when the crank is turned through  $60^\circ$  from inner dead centre. The angular velocity of crank is 20 rad / sec and is increasing at the rate of 60 rad / sec<sup>2</sup>. [8]
- b)** The following data relate to a slider crank mechanism, crank radius = 150 mm, connecting rod length = 650 mm, crankshaft speed = 250 rpm. Determine the following at the instant when the slider has Zero Acceleration by using Klein's construction, (i) the velocity and acceleration of the midpoint of the connecting rod, (ii) the angular velocity and angular acceleration of connecting rod. [7]

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