



## Theory of Machines - I

(124112 / 214112)

P. Pages : 3

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
  2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
  3. Students should note, no supplement will be provided.
  4. All questions are compulsory, solve **any two** bit out of a, b,c in each question.
  5. Solve graphical problems on drawing sheet only.
  6. Assume suitable data if necessary.
  7. Use of non - programmable calculator is allowed.
1. a) How do you classify kinematic pairs ? Illustrate with examples. 8
- b) What do you understand by inversion of a Mechanism ? List various inversions of a four bar chain with diagram. 8
- c) In the four - bar mechanism shown in sig 1.1, link 2 is rotating at angular velocity of 15 rad/sec C. W. Locate all the instantaneous center s of the mechanism and find. 8
- i) The angular speeds of link 3 and 4.
  - ii) The linear velocities of link 3 and 4 and
  - iii) The linear velocities of points E and F.

AB = 200 mm, BC = 250 mm, CD = 300 mm, AD = 500 mm,  $\angle BAD = 60^\circ$  BE = FD = 150 mm.

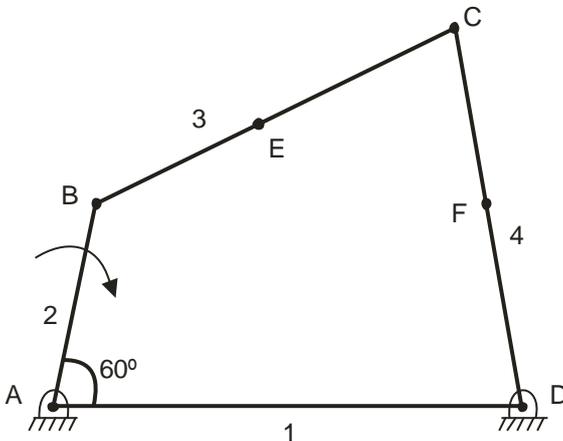


Fig. 1

2. a) Explain the procedure to generate Acceleration diagram for four Bar mechanism. **8**
- b) The crank of a slider crank mechanism rotates a constant speed of 300 r. p. m. The crank is 150 mm and the connecting rod is 600 mm long. Determine angular velocity and angular Acceleration of the connecting rod, at a crank angle of  $45^\circ$  from inner dead center position. **8**
- c) The crank of an engine 300 mm long rotates at a uniform speed of 300 r. p. m. The ratio of connecting rod length to crank radius is 4. Determine. **8**
- Acceleration of the piston
  - Angular acceleration of the rod and
  - Acceleration of a point X on the connecting rod at 400 mm from crank pin. The crank position is  $60^\circ$  from inner dead center (Use Klein's Construction Method)
3. a) Explain straight line motion mechanism & give proof of Peaucellier mechanism. **8**
- b) What is Condition for correct steering ? State & explain Ackerman steering gear. **8**
- c) The connecting rod of a reciprocating engine weight 71.6N, moment of inertia about C .  $G = 0.0565 \text{ kg m}^2$  .  
Distance of C. G. from big end = 102 mm  
length of connecting rod = 305 mm  
Determine the dynamically equivalent system of the connecting rod composed of two point masses for the following cases. **8**
- One of the masses is at big end.
  - One of the masses is at a distance of 152 mm from C. G. forwards small end of the rod,
4. a) Explain **8**
- Type of friction.
  - Laws of solid friction.
  - Angle of Repose.
- b) i) What is the condition of self Locking screw ? Show that efficiency of self Locking screw is less than 50% **4**
- ii) Draw & explain cone clutch. **4**
- c) The thrust on the propeller shaft of a marine engine is taken by eight collar's whose outer and inner diameter are 650 and 400 mm respectively. The thrust pressure is 0.5 MPa and may be assumed uniform. The coefficient of friction between the shaft and collars is 0.05. If the shaft rotates at 120 rpm find **8**
- Total thrust on the collar and
  - Power absorbed by friction at the bearing.

5. a) i) Explain slip of belt & creep of belt. 4
- ii) Explain centrifugal Tension in belt. 4
- b) An open belt drive is used to connect two parallel shafts 4m apart. The diameter of bigger pulley is 1.5m and that of the smaller pulley 0.5m. The mass of the belt is 1 kg/m length. The maximum tension is not to exceed 1500N. The coefficient of friction is 0.25. The bigger pulley which in the driver runs at 250rpm. Due to slip the speed of the driven pulley is 725 rpm. Calculate the power transmitted, Power lost in friction and the efficiency of the drive. 8
- c) i) Explain an expression for the length of chain drive. 4
- ii) A machine which is to rotate at 400 rpm is run by an engine turning at 1500 rpm, through a silent chain, having a pitch of 15 mm. The number of teeth on a sprocket should be from 18 to 105. The linear velocity of chain drive is not to exceed 10m/s. Find the suitable number of teeth for both the sprockets. 4

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