



**SF-8194**

**B. E. - II (Sem. IV) Examination**

**May / June - 2011**

**Kinematics of Machines**

Time : 3 Hours]

[Total Marks : 100

**Instructions :**

(1)

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| नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवही पर अवश्य लिखवी.<br>Fillup strictly the details of signs on your answer book.                          | Seat No. :                                       |
| Name of the Examination :  | <input type="text"/>                             |
| <input type="text" value="B. E. - 2 (SEM. 4)"/>  | <input type="text"/>                             |
| Name of the Subject :  | <input type="text"/>                             |
| <input type="text" value="KINEMATICS OF MACHINES"/>  | <input type="text"/>                             |
| Subject Code No. : <input type="text" value="8"/> <input type="text" value="1"/> <input type="text" value="9"/> <input type="text" value="4"/> | <input type="text" value="Student's Signature"/> |
| Section No. (1, 2,.....) : <input type="text" value="NIL"/>  |  |

- (2) Attempt all questions.  
(3) Make suitable assumptions wherever necessary.  
(4) Figure to the right indicate full marks.

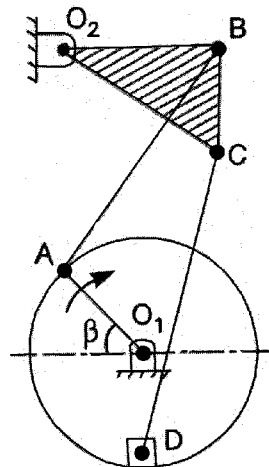
- 1 (a) Answer the following questions (any five) **10**
- (i) Define :
- (a) Mechanism and  
(b) Kinematic chain
- (ii) The pantograph is used to enlarge or reduce the size of a drawing. True or False. Give the justification.
- (iii) Differentiate between Turning pair and sliding pair.
- (iv) Define :
- (a) Initial belt tension and  
(b) Slip
- (v) Define "Instantaneous centre" and list the types of Instantaneous centres.
- (vi) What are the advantages of the belt drives over chain and rope drives ?
- (b) Explain the Inversions of single slider crank chain with neat sketch. **10**
- 2 (a) Derive the equation of "Ratio of Belt Tensions in open belt drive." **7**

- (b) A leather belt is required to transmit 7.5 kW from a pulley 1.20 m in diameter running at 250 r.p.m. The angle embraced is  $165^\circ$  and the co-efficient of friction between leather belt and pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, the density of leather is  $1 \text{ Mg/m}^3$  and the thickness of the belt is 10 mm, determine the width of the belt taking the centrifugal tension into account. 8

OR

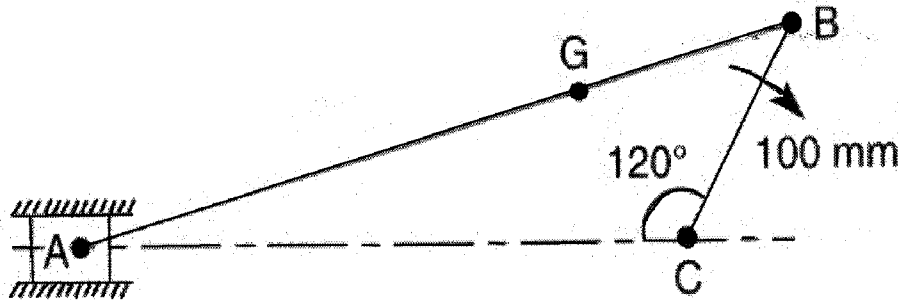
- 2 The following data refer to an open belt drive : 15  
 Diameter of larger pulley = 400 mm; Diameter of smaller pulley = 250 mm; Distance between two pulleys = 2m; coefficient of friction between smaller pulley surface and belt = 0.4; Maximum tension when the belt is on the point of slipping = 1200 N.  
 Find the power transmitted at speed of 10 m/s. it is desired to increase the power. Which of the following two methods you will select ?  
 (i) Increasing the initial tension in the belt by 10%  
 (ii) Increasing the coefficient of friction between the smaller pulley surface and belt by 10% by the application of suitable dressing on the belt.  
 Find, also, the % increase in power possible in each case.

- 3 Fig. shows a sewing needle bar mechanism,  $O_1ABO_2CD$  15  
 wherein the different dimensions are as follows :  
 Crank  $O_1A = 16 \text{ mm}$ ; angle  $\beta = 45^\circ$ ; vertical distance between  $O_1$  and  $O_2 = 40 \text{ mm}$ ; Horizontal distance between  $O_1$  and  $O_2 = 13 \text{ mm}$ ;  $O_2B = 23 \text{ mm}$ ;  $AB = 35 \text{ mm}$ ; angle  $O_2BC = 90^\circ$ ;  $BC = 16 \text{ mm}$ ;  $CD = 40 \text{ mm}$ . D lies vertically below  $O_1$ .  
 Find the velocity of needle at D for the given configuration.  
 The crank  $O_1A$  rotates at 400 r.p.m.



OR

- 3 (a) Give the complete classification of “Kinematic pair”. 3
- (b) An engine mechanism is shown in Fig. the crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s<sup>2</sup>. Find : 12
- (i) Velocity of G and angular velocity of AB and
- (ii) Acceleration of G and angular acceleration of AB.



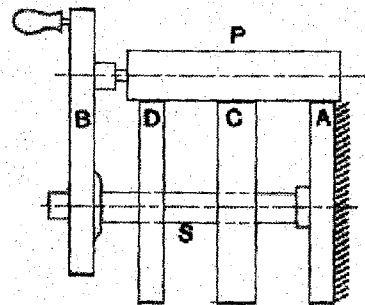
- 4 (a) Attempt the following :
- (i) Explain the following terms : 4
- (a) Cam angle
- (b) Dedendum
- (c) Prime circle
- (d) Arc of approach
- (ii) Explain the laws of Static Friction. 2
- (iii) Why is backlash in gears necessary ? 1
- (iv) What are the method of avoid interference ? 1
- (v) Show figure of a cylindrical cam with oscillating follower. 1
- (vi) In an involute tooth profile the pressure angle is 20° and path of contact is 45 mm. What is the arc of contact ? 1
- (b) A cam is to give the following motion to a knife-edged follower : 10
- (i) Outstroke during 60° of cam rotation;
- (ii) Dwell for the next 30° of cam rotation;
- (iii) Return stroke during next 60° of cam rotation, and
- (iv) Dwell for the remaining 210° of cam Rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower is offset by 20 mm from the axis of the cam shaft.

- 5 (a) Derive an expression for the minimum number of teeth required on the pinion in order to avoid interference in involute gear teeth. 7
- (b) The contact surfaces in a cone clutch have an effective diameter of 75 mm. The semi-angle of the cone is  $15^\circ$ . The coefficient of friction is 0.3. Find the torque required to produce slipping of the clutch if an axial force applied is 180 N. This clutch is employed to connect an electric motor running uniformly at 1000 r.p.m. with a Flywheel which is initially stationary. The flywheel has a mass of 13.5 kg and its radius of gyration is 150 mm. Calculate the time required for the flywheel to attain full speed and also the energy lost in the slipping of the clutch. 8

OR

- 5 (a) Describe with a neat sketch the working of Cone clutch. 7
- (b) Figure shows an epicyclic gear train known as Ferguson's paradox. Gear A is fixed to the frame and is, therefore, stationary. The arm B and gears C and D are free to rotate on the shafts S. Gear A, C and D have 100, 101 and 99 teeth respectively. The planet gear has 20 teeth. The pitch circle diameters of all are the same so that the planet gear P meshes with all of them. Determine the revolutions of gears C and D for one revolution of the arm B. 8



- 6 (a) State and prove the Law of gearing. Show that involute profile satisfies the condition for correct gearing. 7
- (b) Two involute gears of  $20^\circ$  pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2 if the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find : 8
- (i) The angle turned through by pinion when one pair of teeth is in mesh; and
- (ii) The maximum velocity of sliding.