Question Paper

Exam Date & Time: 26-Dec-2019 (08:30 AM - 11:30 AM)



DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING THIRD SEMESTER B.TECH END SEMESTER MAKE-UP EXAMINATIONS, DEC 2019 KINEMATICS OF MACHINERY [MME 2151]

Marks: 50

Duration: 180 mins.

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

- A leather belt transmits 10 kW from a motor running at 600 rpm by an open ⁽³⁾ belt drive. The diameter of the driven pulley is 350 mm, centre distance between the pulleys is 4 m, and the speed of the driven pulley is 180 rpm. The belt weighs 1100 kg/m³, and the maximum allowable tension in the belt is 2.5 N/mm². The coefficient of friction = 0.25. Find the width of the belt, assuming the thickness to be 10 mm. Neglect the belt thickness to calculate the velocities.
 - B) Determine the power lost in overcoming friction in the bearing and the ⁽³⁾ number of collars required for a bearing whose contact surfaces have 200 mm external radius and 120 mm internal radius. The coefficient of friction is 0.08. The total axial load is 29450 N, the intensity of pressure is 34.4 N/cm², and the shaft speed is 420 rpm. Assume Uniform pressure intensity at the contact surfaces.
 - C) A pair of involute spur gears in mesh has 16° pressure angle and pitch of ⁽⁴⁾ module 6 mm. The number of teeth on the pinion is 16, and its rotational speed is 240 rpm. The gear ratio is 1.75, and the addendum is same on both the gears. If the interference is just avoided, find addendum on the gear, and contact ratio.
- With the help of a neat sketch explain crank and slotted lever quick return ⁽³⁾ motion mechanism and also show that the time of return stroke is less than that of the forward stroke.
 - ^{B)} With the help of a neat sketch explain the working of the Ackerman Steering ⁽³⁾ Gear Mechanism.
 - C) For the mechanism shown in the figure 1 find, the velocity of the slider and ⁽⁴⁾ the angular velocity of the connecting rod CB using instantaneous centre method. The crank rotates with an angular velocity of 5 rad/s clockwise and makes an angle 45°. Link OB = 40 mm, BC = 100 mm and the separation between the centre is 70 mm.



Figure 1

- 3) The thickness of involute gear tooth is 7.98 mm at a radius of 88.9 mm and $^{(3)}$ pressure angle of 14¹/₂°. Calculate the tooth thickness and radius at a point A) on the involute tooth, which has a pressure angle of 25°. Also, determine the radius of the base circle.
 - B) A cam with 40 mm minimum radius is rotating clockwise at 250 rpm and ⁽⁷⁾ imparts the follower motion to knife edge follower. The conditions are as follows: Lift = 35 mm; follower rises during 120° cam rotation with simple harmonic motion (SHM); follower dwells for 60° cam rotation; follower returns during 90° cam rotation with uniform acceleration and retardation motion; follower dwells for the remaining period; and the axis of the follower is offset towards the right by 10 mm. Draw the profile of the cam.
- 4) Sketch the differential gear mechanism of an automobile and label all the (2) parts. A)

B)

- An epicyclic gear train is shown in figure 2 below. The number of teeth on ⁽⁴⁾ gear A and B are 80 and 200 respectively. Determine the speed of the arm "a" if
 - (i) Gear A rotates at 100 rpm clockwise and B at 50 rpm counter-clockwise.
 - (ii) Gear A rotates at 100 rpm clockwise and B is stationary.



Figure 2

^{C)} Derive the equations to determine the length of path of contact and the ⁽⁴⁾ length of arc of contact when two gears are in mesh.

State and prove Arnold Kennedy's theorem.

(3)

A) B)

5)

For the linkages shown in figure 3, the crank OA rotates at 3000 rpm. Find ⁽⁷⁾ the velocity (using relative velocity method) and the acceleration of the point C in magnitude and direction. Also find the angular acceleration of link 3.

The dimensions of the link are, AO = 50 mm, AD = 175 mm, AC = 75 mm, DC = 125 mm.



Figure 3

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