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RN-8223

B. E. II (Sem. IV) (Mechanical) Examination

May / June – 2010

Kinematics of Machines

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 2 (Sem. 4) (Mechanical)**

Name of the Subject :

☛ **Kinematics of Machines**

☛ Subject Code No. : **8 2 2 3** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Use separate answer book for each section.
(3) Figures to the **right** indicate **full** marks.
(4) Assume suitable data, if necessary.

SECTION – I

1 (a) Answer the following : (any five) **10**

(1) Define :
  (a) Mechanism
  (b) Kinematic pair.

(2) Oldham's coupling and Elliptical trammels are the inversions of _____.

(3) Differentiate between machine and structure.

(4) Define "Instantaneous centre" and list the types of instantaneous centres.

(5) List the types of pulleys.

(6) What are the disadvantages of the belt drives over chain and rope drives ?

(b) Explain the following : **10**

(1) Whitworth quick return motion mechanism

(2) Ackerman's steering mechanism.

2 (a) Derive the equation of "Length of the belt for the cross belt drive." 7

(b) A pulley, used to transmit power by means of ropes, has a diameter of 3.6 m and has 15 grooves of 45° angle. The angle of contact is 170° and the coefficient of friction between the ropes and the groove side is 0.28. The maximum possible tension in the ropes is 960 N and the mass of the rope is 1.5 kg per m length. What is the speed of the pulley in r.p.m. and the power transmitted if the condition of maximum power prevail ? 8

OR

2 A shaft which rotates at a constant speed of 160 r.p.m. is connected by belting to a parallel shaft 72 cm apart which has to run at 60, 80 and 100 r.p.m. the smallest pulley on the driver shaft is 4 cm in radius. Determine the remaining radii of the two stepped pulleys for (a) a crossed belt, (b) an open belt. Neglect belt thickness and slip. 15

3 A mechanism of a crank and slotted quick return motion is shown in figure. If the crank rotates counter - clockwise at 120 r.p.m., determine (for the configuration shown) the velocity and acceleration of the ram. Also determine the angular acceleration of the slotted lever. Crank OA = 15 cm, slotted arm O_1C = 70 cm and link CD = 20 cm. (Fig.01) 15

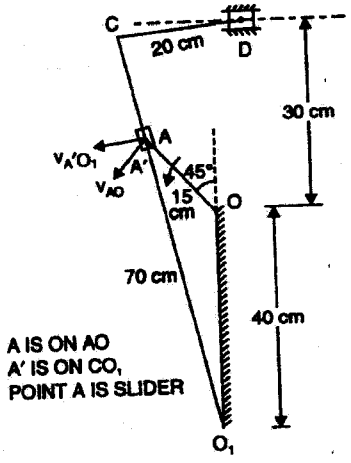

Fig.01

OR

3 For the configuration of a slider-crank mechanism shown in figure. Determine : 15

(i) The acceleration of the slider

(ii) The acceleration of point E

(iii) Tha angular acceleration of link AB.

The crank OA rotates at 200 r.p.m. clockwise. OA=500 mm, AB=1500 mm and AE=450 mm. (Fig.2)

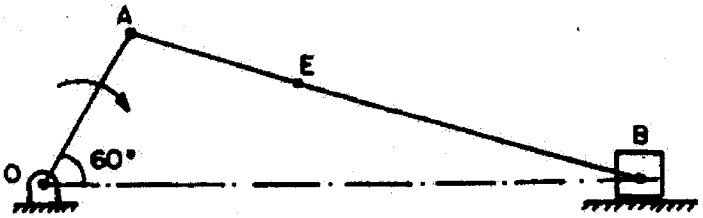

Fig.2

SECTION – II

4 (a) Attempt the following :

(1) Explain the following terms : **4**
(a) Cam angle (b) Addendum (c) Prime circle
(d) Diameter pitch.

(2) Show figure of a cylindrical cam with reciprocating follower. **1**

(3) Classify chains on the basis of their use. **1**

(4) What are the method of avoid interference ? **1**

(5) Why is backlash in gears necessary ? **1**

(6) If the initial tension in the belt is increased, the power transmitted by the belt, **1**
(a) Reduces
(b) Increases
(c) Remains the same
(d) Both (a) and (b).

(7) In an involute tooth profile the pressure angle is 20^{o} and path of contact is 45 mm. What is the arc of contact ? **1**

(b) A cam is to be designed for a knife edge follower with the following data : **10**

(1) Cam lift = 40 mm during 90^{o} of cam rotation with simple harmonic motion.

(2) Dwell for the next 30^{o}.

(3) During the next 60^{o} of cam rotation the follower returns to its original position with simple harmonic motion.

(4) Dwell during the remaining 180^{o}.

Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during ascent and descent, if the cam rotates at 240 r.p.m.

5 (a) Derive relation for the ratio of tensions in the tight side and slack side of a band and block brake. 7

(b) A band and block brake, having 12 blocks each of which subtends an angle of 13° at the centre, is applied to the drum of 1 m effective diameter. The drum and flywheel mounted on the same shaft has a mass of 2000 kg and a combined radius of gyration of 500 mm. The two ends of the band are attached to pins on opposite side of the brake lever at distance of 30 mm and 120 mm from the fulcrum. If a force of 200 N is applied at a distance of 750 mm from the fulcrum, find : 8

(a) Maximum braking torque

(b) Angular retardation of the drum

(c) Time taken by the system of come to rest from the rated speed of 360 rpm, $\mu = 0.3$

OR

5 (a) Describe with a neat sketch the working of centrifugal clutch. 7

(b) A pair of 20° full depth involute spur gear having 30 and 50 teeth respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 rpm. Determine : (1) sliding velocities at engagement and at disengagement of pair of a teeth, and (2) contact ratio. 8

6 (a) Write in brief : Velocity of sliding. 7

(b) A pair of spur gears with involute teeth is to give a gear ratio of 4:1. The arc of approach is not to be less than the circular pitch and smaller wheel is the driver. The angle of pressure is 14.5°. 8

Find :

(1) the least number of teeth that can be used on each wheel, and

(2) the addendum of the wheel in terms of the circular pitch ?

OR

(b) Draw the types of cams and types of followers. 8
