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RN-6261

B. E. II (Sem. III) (Mech.) Examination

May / June – 2010

Theory of Machine - I

Time : **3** Hours] [Total Marks : **70**

Instruction :

(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. 1 (Sem. 3) (Mech.)**

Name of the Subject :

☛ **Theory of Machine - 1**

☛ Subject Code No. : **6 2 6 1** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Attempt all questions.
(3) Figures to **right** indicate full marks.
(4) Assume suitable data if required.

SECTION - I

1 (a) Difference between (i) Machine and Mechanism **20**
(ii) Lower and Higher pair.
(b) Explain the different types of constrained motions.
(c) State and prove the Kennedy's theorem.
(d) Explain the inversions of single slider crank chain.

2 **Fig. 1** shows a sewing needle bar mechanism. The **15**
crank rotates at 400 rpm. The various dimensions are
O_1A = 16 mm, O_2B = 23 mm AB = 35 mm
BC = 16mm $\angle O_2BC = 90^o$, CD = 40 mm.
Locate all the I-centres find velocity of D.

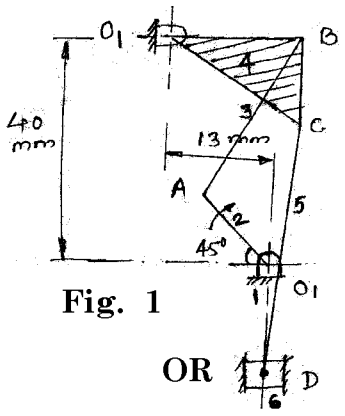

Fig. 1

2 In mechanism shown in figure-2 the dimensions are OC=125 mm, CP = 500 mm PA = 125 mm AQ = 250 mm QE = 125 mm. Draw velocity polygon and find velocity E. **15**

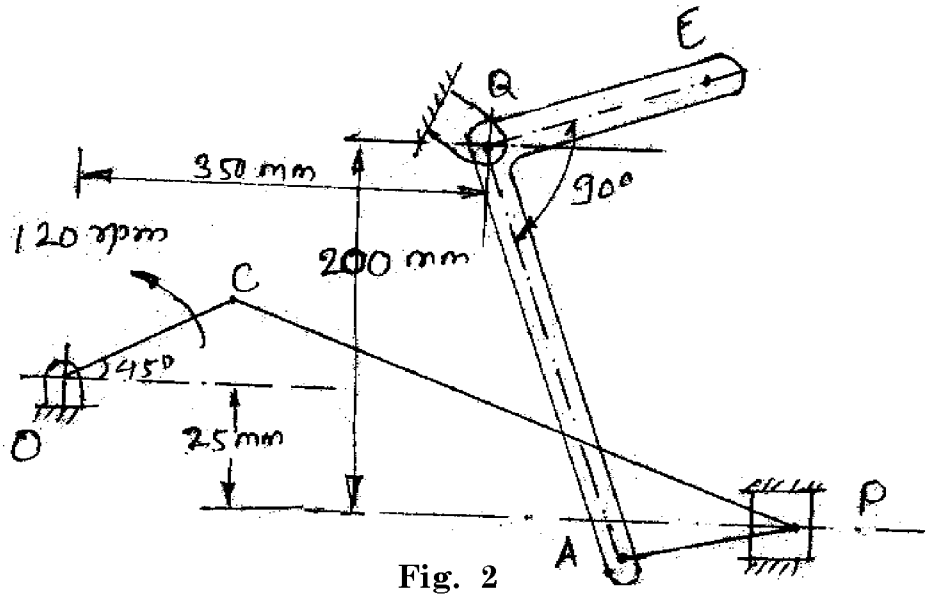

Fig. 2
(Not to scale)

3 Figure 3 shows a slider crank mechanism. By polygoan method find acceleration of B&Q. **15**
OA = 7.5 cm
AB = 30 cm
AQ = 5 cm

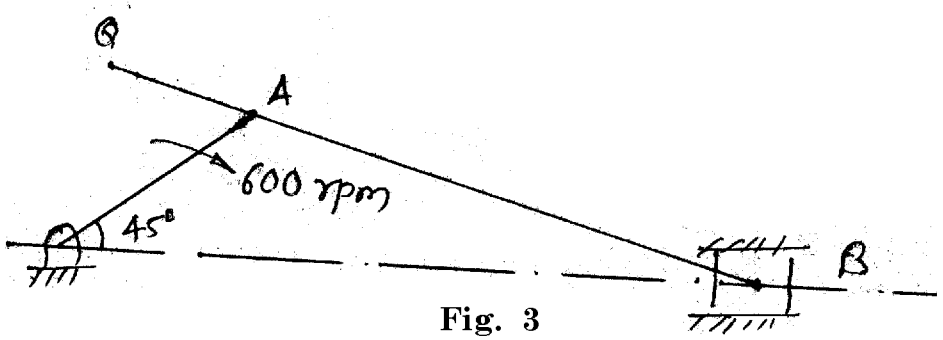

Fig. 3
(Not to scale)

SECTION - II

4 (a) Attempt the following :

(i) What are the different types of motions with which a follower can move? **1**

(ii) Define : pitch curve. **1**

(iii) Gives names of metallic and non-metallic materials used for gear manufacturing. **1**

(iv) Which two types of ropes are used in rope drives? **1**

(v) What is the relation between centrifugal tension and the maximum tension in the belt, when the power transmitted by the belt is maximum? 1

(vi) The 'crowning' of the flat pulley is generally done. 1

(a) To reduce belt friction.

(b) To prevent the belt running off the pulley.

(c) To increase the strength of the belt.

(d) To increase the power transmitted by the drive.

(vii) Explain the following terms : 4

(a) Deddendum

(b) Addendum

(c) Prime circle

(d) Pressure angle.

(b) The following data relate to a cam profile, in which the follower moves with S.H.M. during the lift and returning it with uniform acceleration and deceleration, acceleration being half the deceleration. 8

Minimum radius of cam = 30 mm

Lift of the follower = 45 mm

Angle of ascent = 70^{o}

Roller radius = 10 mm

Offset of follower axis = 12 mm toward right

Angle of descent = 120^{o}

Angle of dwell between ascent and decent = 45^{o}

Speed of cam = 200 rpm

Draw the cam profile and determine maximum velocity, maximum acceleration during lift.

5 (a) Derive the expression for centrifugal tension for flat belt drive. 7

(b) A shaft rotating at 90 rpm drives another shaft at 225 rpm and transmits 10.5 kW through a belt. The belt is 115 mm wide and 12 mm thick and the coefficient of friction between the belt and the pulley is 0.25. The distance between the shaft is 2.75m and the smaller pulley is of 600 mm diameter. Calculate the stress in the belts if it is (i) an open belt drive (ii) cross belt drive. 8

OR

5 (a) Derive the equation for length of belt of a cross-belt drive. 7

(b) The following data refer to **two** mating involute gears of 20^{o} pressure angle. 8

Number of teeth on pinion = 20
Gear ratio = 2
Speed of pinion in rpm = 250
Module = 10

If the addendum of each is such that the path of approach and path of recess on each side are of half the maximum possible length, find

(i) The adendum of pinion and gear
(ii) The length of path of contact
(iii) The maximum velocity of sliding during approach and recess.

6 (a) Prove that the velocity of sliding is proportional to the distance of the point of contact from the pitch point. **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^{o}. 8

Find :

(i) the least number of teeth that can be used on each wheel.
(ii) the addendum of the wheel in terms of the circular pitch.
