(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2102   Roll No. ☐☐☐☐☐☐☐☐☐☐

B.Tech.

(SEMESTER-V) THEORY EXAMINATION, 2012-13

THEORY OF MACHINES – I

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

Notes : (1) This question paper consist of **three** Section – A, B & C. Section – A carries **20** marks Section – B carries **30** marks and Section – C carries **50** marks.

(2) Assume suitable data if any.

Section – A

1.   Attempt **all** the parts :   2 × 10 = 20

(a)   What do you mean by degree of freedom of a kinematic pair ? Explain with example.

(b)   Distinguish between :

(i)   Machine and structure

(ii)   Lower and Higher pairs

(c)   What do you mean by coriolis component of acceleration ?

(d)   State the Arnhold Kennedy's theorem ?

(e)   What are the uniform pressure and uniform wear theories ?

(f)   Classify the different types of brakes.

(g)   List the different types of motions of the follower.

(h)   Which follower programme do you recommend for a high speed cam and why ?

(i)   Define the fundamental law of gearing.

(j)   List the different types of gear trains. Also define the term train value.

Section – B

2. Answer any **three** parts : 10 × 3 = 30

(a) Describe the Whitworth Quick return motion mechanism with the help of neat sketch. A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120mm. Find the ratio of the time of cutting to the time of return stroke.

(b) Describe the Klein's construction to determine velocity and acceleration of the piston in a slider crank mechanism.

(c) What do you mean by creep of belt ? Derive the condition for maximum power transmission by a belt drive considering the effect of centrifugal tension.

(d) Deduce expressions for the velocity and acceleration of the follower when it moves with simple harmonic motion .

(e) Define interference in gears. Derive an expression for minimum number of teeth required on a pinion to avoid interference when it gears with a rack.

Section – C

Answer **all** parts : 10 × 5 = 50

3. In a slider crank mechanism, the length of crank OB and connecting rod AB are 125 mm and 500mm respectively. The centre of gravity G of the connecting rod is 275 mm from the slider A. The crank speed is 600 rpm clockwise. When the crank has turned 45° from the inner dead centre position, determine: 1. Velocity of slider A 2. Velocity of point G 3. Angular velocity of the connecting rod AB.

OR

In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise, while the link CD = 80mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°

4. Sketch a Paucellier mechanism. Show that it can be used to trace a straight line.

OR

Sketch and explain the Hart's mechanism.

5. Distinguish between a brake and dynamometer. Derive the relation for the friction torque for self expanding brake.

OR

In a thrust bearing, the external and the internal diameters of the contacting surfaces are 320 mm and 200 mm respectively. The total axial load is 80 kN and the intensity of pressure is 350 kN/m^2. The shaft rotates at 400 rpm. Taking the coefficient of friction as 0.06, calculate the power lost in overcoming the friction. Also find the number of collars required for the bearing.

6. A cam drives a Knife edge reciprocating follower in the following manner:

During first 120° rotation of the cam, the follower moves outwards through a distance of 20 mm with S.H.M .The follower dwells during next 30° of csm rotation. During next 120° of cam rotation the follower moves inwards with S.H.M. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

OR

A tangent cam with a base circle diameter of 50 mm operates a roller follower 20 mm in diameter. The line of stroke of the roller follower passes through the axis of the cam. The angle between the tangential faces of the cam is 60°, speed of the cam shaft 200 rpm and the lift of the follower 15 mm. calculate,(i) Main dimensions of the cam (ii) The acceleration of the follower at the beginning of lift and at the apex of the circular nose.

7. Two 20° involute spur gears have module of 10 mm. The addendum is one module. The larger gear has 50 teeth and the pinion 13 teeth. Does the interference occur ? If it occurs, to what value should the pressure angle be changed to eliminate interference ?

OR

What is a sun and planet gear ? Give the procedure to analyse such a gear train.