B.Tech Sem – IV (2007 Course) (Production Engg.) : WINTER · 2017

SUBJECT : THEORY OF MACHINES

Day : **Wednesday** Time : **02.30 PM TO 06.30 PM**

Date : **22/11/2017** **W-2017-2431** Max. Marks : 80

N.B.:

1) **Q.No.1** and **Q.No.5** are **COMPULSORY**. Out of the remaining questions attempt **ANY TWO** questions from each section.
2) Answers to both the sections should be written in the **SEPARATE** answer books.
3) Draw neat and labeled diagrams **WHEREVER** necessary.
4) Figures to the right indicate **FULL** marks.
5) Assume suitable data if necessary.

SECTION – I

Q.1 **a)** Explain with sketches classification of kinematic pairs. **[05]**

b) Explain with sketch 'Hart Mechanism'; prove that it produces an exact straight line motion. **[05]**

c) Explain the terms space centrode and body centrode. **[04]**

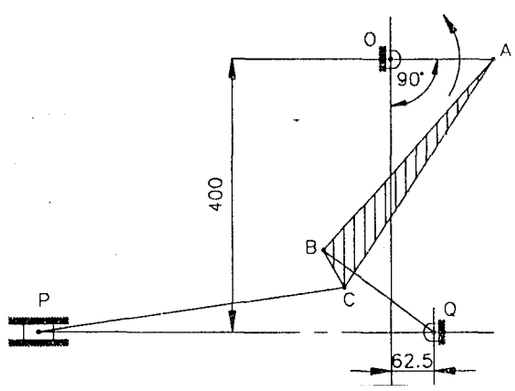
Q.2 **a)** Derive an expression for the magnitude and direction of coriolis component of acceleration. **[06]**

b) The intermediate shaft has a moment of inertia 30.4 kg/m^2 and is inclined at 30^0 to the axis of the driving and driven shafts. If the driving shaft rotates at 2400 rpm, with a steady torque of 272 N-m, determine the maximum fluctuation of the output torque. **[07]**

Q.3 **a)** Explain with sketch different types of constrained motion. **[06]**

b) In a slider crank mechanism, the crank is 50 mm long and connecting rod 200 mm long. When crank has moved through 30^0 from inner dead centre position the velocity of slider is 2 m/sec. Find using Klein's construction angular acceleration of connecting rod and acceleration of centre of gravity of connecting rod which is situated at a distance of 80 mm from big end. **[07]**

Q.4 As shown in the figure, the crank OA makes 150 rpm. Find for the given configuration, the velocity and acceleration of piston P and the angular velocities and angular accelerations of links ABC and CP. **[13]**



OA = 150 mm
AB = 375 mm
AC = 400 mm
BC = 62.5 mm
BQ = 200 mm
CP = 450 mm

P.T.O.

SECTION – II

Q.5 **a)** Explain with neat sketch 'Dynamic Balancing Machines'. **[05]**

b) For the four bar linkage, the following data are given: **[05]**
$\theta_2 = 60^0$, $\theta_4 = 90^0$, $\omega_2 = 3$ rad/sec, $\omega_4 = 2$ rad/sec, $\alpha_2 = -1$ rad/sec^2, $\alpha_4 = 0$.
Determine the link length ratios.

c) Sketch and explain classification of follower based on types of movement of follower. **[04]**

Q.6 **a)** Derive the frequency equation for trifilar suspension. **[06]**

b) In the slider crank mechanism, the crank is 200 mm long and connecting rod 750 mm long. The piston is 80 mm in diameter and a pressure difference of 2 MPa exists between two sides of piston when crank has moved through 45^0 from top dead centre position find: **[07]**

i) Thrust in connecting rod
ii) Reaction from guide
iii) Torque active on crank shaft
iv) Load on main bearings

Q.7 The following particulars rotate to the cam which is operating an oscillating knife – edge follower: **[13]**

Base circle radius	= 30mm
Distance between pivot of the lever and the knife-edge point	= 40mm
Distance between the pivot and cam centre	= 55mm
Total angle of oscillation for the follower	= 28^0
Angle of ascent	= 75^0
Angle of outer dwell	= 60^0
Angle of descent	= 105^0

Draw the cam profile if ascent and descent, both takes place with S.H.M.

Q.8 A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100^0 and that between the masses of B and A is 190^0 both being measured in the same direction. The axial distance between A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: **[13]**

i) The magnitude of the masses at A and D.
ii) The distance between the planes A and D.
iii) The angular position of the mass at D.

* * * *