Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) EXAMINATION – SUMMER 2016

Subject Code:2142504 **Date:08/06/2016**

Subject Name:Theory of Machines

Time:10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use drawing sheet for graphical solutions & answer-book for analytical/theoretical answers.**
5. **Write complete statement after selecting suitable choice for the objective type of questions.**

Q.1 **Short Questions (All the questions carry equal marks)** **14**

1 Define mechanism.

2 Define flexible link & give its example.

3 State the condition for correct steering gear ratio.

4 State major applications of Hooke's joint.

5 Write the statement of Arnold-Kennedy's theorem.

6 Write the expression for finding the Coriolis component of acceleration with the meaning of notations used.

7 What is the advantage of crowning of pulleys?

8 The velocity ratio of the gear should be: (a) 1 (b) More than 1 (c) Less than 1 (d) Any of the above. Complete the statement by selecting correct answer.

9 What is the major advantage of cycloidal tooth profile?

10 For which type of follower, the cam profile and the cam pitch profile is same?

11 What is overhauling of screw jack?

12 Among which clutch heat dissipation is a serious problem?
(a) Positive clutch (b) Multiplate clutch (c) Centrifugal clutch (d) Cone clutch

13 What is the limitation of Gruebler's criterion?

14 Define accuracy point as regards to kinematic synthesis.

Q.2 **(a)** A double Hook's joint is used to connect two shafts in the same plane and the intermediate shaft is at an angle of 20° to both the shafts. If the driving shaft rotates at 300 rpm, find the maximum and minimum speeds of the intermediate and driven shafts. **03**

(b) For the mechanisms shown in Figure – 1 below, show whether the mechanism is locked, constrained or unconstrained giving reason for the same by due calculations. **04**

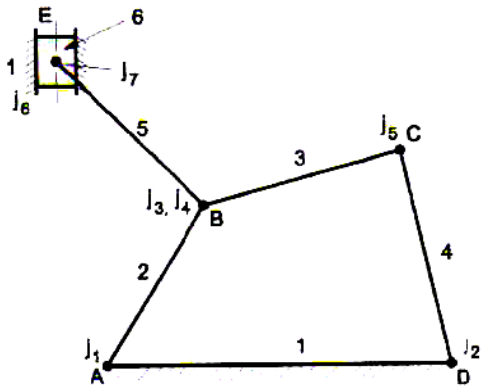

Figure – 1

(c) Figure -1 in Q.2 (b) above shows a mechanism in which the crank AB rotates at a uniform speed of 420 rpm in clockwise direction & link AD is fixed. Determine: (i) the velocity of slider E & (ii) the angular velocity of link BE. Dimensions of various links are: AD = 80 mm, AB = 50 mm, BC = 60 mm, CD = 60 mm, BE = 60 mm and angle between links AB & AD is 60°. Use relative velocity method only. **07**

OR

(c) Write the steps for finding velocity & acceleration of a slider crank mechanism, when crank rotates uniformly, by Klein's construction. Show all expressions for velocity & acceleration of crank, connecting rod and piston. **07**

Q.3 (a) Classify kinematic pairs by all ways of classification. **03**

(b) Draw pantograph mechanism with proportions of links shown and state its applications. **04**

(c) Draw the profile of a cam to raise a valve with SHM through 40 mm in 90°, keep it fully open for 36° and to lower it with uniform & equal acceleration & retardation in 60° revolutions of cam. The valve remains closed during the rest of the cam revolution. The diameter of roller of the valve is 20 mm and the minimum radius of cam is 40 mm. The axis of the valve passes through the axis of cam shaft. Also determine the maximum velocity during outstroke and maximum acceleration during return stroke of the valve respectively if the crank shaft rotates at 360 rpm. **07**

OR

Q.3 (a) Classify & explain instantaneous centers with neat sketches. **03**

(b) In a tangent cam operating a roller follower has base circle radius of 15 mm and roller radius is 10 mm. the angle of ascent is 75° and the total lift of follower is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate: (i) the main dimensions of the cam (ii) the acceleration of follower at the beginning of the lift. **04**

(c) The following data refer to two mating involute gears of 20° pressure angle: Number of teeth on pinion = 20, Gear ratio = 2, Speed of pinion = 250 rpm & Module = 12 mm. **07**

If the addendum on each wheel is such that the path of approach & path of recess on each side are of half the maximum possible length each; find (i) the addendum for pinion & gear wheel (ii) the length of arc of contact (iii) maximum velocity of sliding during recess.

Q.4 (a) Classify gears by three major ways of classification (No sketches). **03**

(b) Explain the single plate clutch in terms of elements, working and applications. **04**

(c) Design & draw four bar chain mechanism using Freudenstein's equations with three accuracy points and Chebyshev spacing so that the input & output angles will be coordinated as follows: **07**

Input angle(θ)	46°	68°	85°
Output angle(Φ)	100°	110°	122°

Use algebraic method for the solution. Draw the mechanism in drawing sheet using calculated dimensions only.

OR

Q.4 **(a)** State different types of brakes. **03**

(b) For a screw jack, derive an expression for torque required to raise the load with usual notations. **04**

(c) Design & draw a single slider crank chain mechanism OAB by inversion method in which two successive angular displacements Θ_{12} & Θ_{13} of crank produce displacements S_{12} & S_{13} of slider as given below: **07**

Θ_{12}	Θ_{13}	S_{12}	S_{13}	O_2B_1
-65°	-130°	50 mm	100 mm	90 mm

Q.5 **(a)** State different belt materials and their specific applications. **03**

(b) Classify gear trains with a sketch of each one of them. **04**

(c) Derive the expression for the exact length of the belt for an open belt drive with usual notations. **07**

OR

Q.5 **(a)** Write the advantages & disadvantages of involute gear teeth profile. **03**

(b) What are the phases of kinematic synthesis? Explain any one phase. Define structural error for kinematic synthesis. **04**

(c) Two pulleys one 450 mm diameter and other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find (i) the length of belt required and (ii) the angle of contact between the belt & each pulley. (iii) What power can be transmitted by the belt when the larger pulley rotates at 200 rpm, if the maximum permissible tension in the belt is 1000 N and the coefficient between the belt & the pulleys is 0.25? **07**

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