Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New)• EXAMINATION – WINTER 2016

Subject Code:2131906 Date:09/01/2017

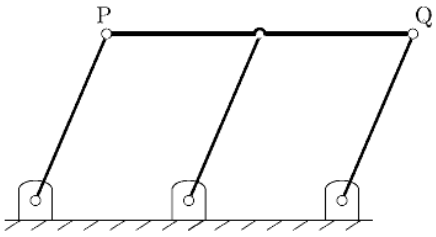
Subject Name:Kinematics of Machines

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.**

			MARKS
Q.1		**Short Questions**	**14**
	1	Find the number of degrees of freedom of a cylinder which is located in a V-block	
	2	Define completely constrained motion	
	3	Define Resistant bodies	
	4	Define Kinematics of Machines	
	5	Why Roller follower is preferred over knife edge follower?	
	6	State any two types of motion of the follower.	
	7	State two applications of Cam and Followers	
	8	Define Inversion of mechanism	
	9	Which type of gear box is used in automobiles?	
	10	Calculate speed of driving shaft in compound gear train, if the drivers have 50, 60, 80 and 100 teeth and followers have 18, 40, 60 and 80 teeth. Speed of driven shaft is 150 rpm	
	11	Why is double Hooke's joint used?	
	12	What do you understand by synthesis?	
	13	Difference between Velocity and Speed.	
	14	One quaternary joint is equal to how many binary joints?	
Q.2	**(a)**	A double-parallelogram mechanism is shown in the figure. Note that PQ is a single link. The mobility of the mechanism is	**03**



(b) Match the items in columns I and II **04**

Column I	Column II
P. Higher Kinematic Pair	1. Grubler's Equation
Q. Lower Kinematic Pair	2. Line contact
R. Quick Return Mechanism	3. Surface contact
S. Mobility of a Linkage	4. Shaper

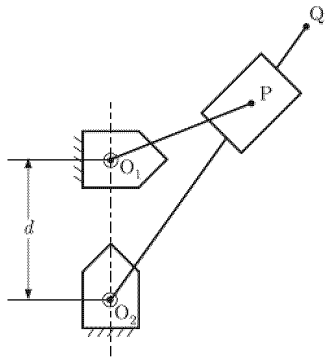
(c) Explain chebyshev spacing method for location precision point position in four bar chain mechanism. **07**

OR

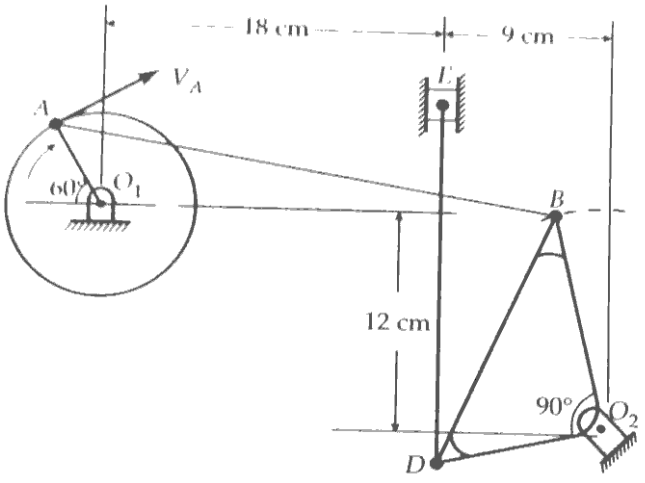
(c) Design a four bar mechanism with input link **a**, output link **c**. Angle ɵ and φ for three successive positions are given in table. Use Freudenstein's method. Draw the mechanism in second position. **07**

Position	**1**	**2**	**3**
ɵ	30	50	70
φ	40	75	100

Q.3 **(a)** A simple quick return mechanism is shown in the figure. The forward toreturn ratio of the quick return mechanism is 2:1. If the radius of crank $O_1P$is 125 mm, then what will be the distance'd ' (in mm) between the crank centre to lever pivot centre point ? **04**



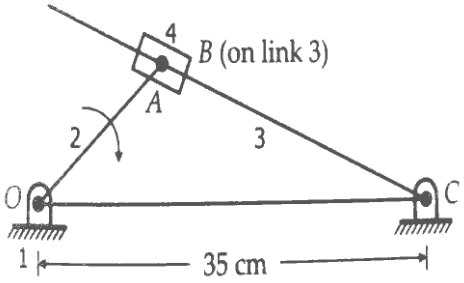
(b) Using relative velocity method to find the absolute velocity of the slider E in the mechanism as shown in fig., when the crank rotates at 60 rpm. **10**
O_1A=5cm, O_2B=12cm, AB= 27cm, O_2D=9cm, DE= 18cm



OR

Q.3 **(a)** A solid disc of radius 'r' rolls without slipping on a horizontal floor withangular velocity ω and angular acceleration α. **04**
Determine magnitude of theacceleration of the point of contact on the disc.

(b) A Quick return mechanism is shown in fig. Link 2 rotates at 20 rad/sec. Draw the velocity and acceleration diagram. Given BC=25 cm, OA=15 cm. **10**



Q.4 **(a)** Types of Cam with sketch **04**

(b) A cam operates an offset follower. The least radius of the cam is 50mm, roller diameter is 30mm, and offset is 20mm. The cam operates at 360 rpm. The angle of ascent is 48^0, angle of dwell is 42^0 and angle of descent is 60^0. The motion is SHM during ascent and uniform acceleration and retardation during descent. Draw the cam profile. Consider lift of cam as 40 mm. **10**
Also calculate max velocity and acceleration during descent.

OR

Q.4	**(a)**	Types of follower with sketch	**04**
	(b)	A cam operates a flat-faced follower having uniform acceleration and retardation during ascent and descent. The least radius of the cam is 50mm. During descent, the retardation period is half of the acceleration period. The ascent lift is 37.5mm. The ascent is for $1/4^{th}$ period, dwell for $1/4^{th}$, descent for $1/3^{th}$, and dwell for the remaining $1/6^{th}$ period. The cam rotates at 600 rpm. Find the max velocity and acceleration during ascent and descent. Draw the cam profile.	**10**
Q.5	**(a)**	Comparison between Involute and Cycloidal tooth profile.	**03**
	(b)	Fundamental Law of Gearing.	**04**
	(c)	Two 20^0 involute gears in mesh have a gear ratio of 2 and 20 teeth on the pinion. The module is 5mm and the pitch line speed is 1.5 m/s. Assuming addendum to be equal to one module, find (a) angle turned through by pinion when one pair of teeth are in mesh, and (b) maximum velocity of sliding.	**07**

OR

Q.5	**(a)**	State any three application of Gear Train.	**03**
	(b)	How the direction of rotation of driven shaft can be found out if it has even and odd number of gears in a gear train? Explain with sketch.	**04**
	(c)	In a reverted epicyclic gear train, the arm F carries two wheels A and D and a compound wheel B, C. The wheel A meshes with wheel B and the wheel D meshes with wheel C. Z_A=80, Z_D=48 and Z_C=72. Find the speed and direction of wheel D when wheel A is fixed and arm F makes 240 rpm clockwise.	**07**

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