Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: 143401 **Date: 19-12-2013**

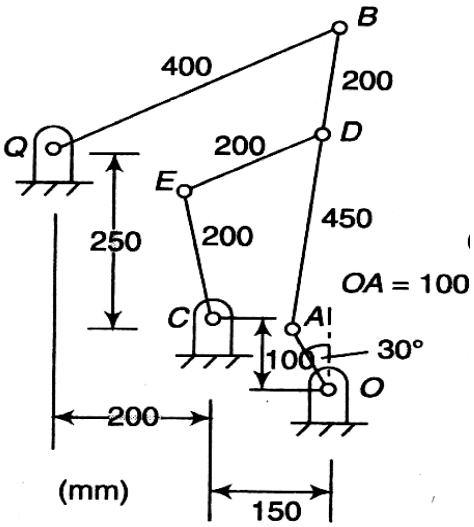
Subject Name: Machines and Mechanisms

Time: 2.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	(i)	What are rigid and resistant bodies? Elaborate.	**03**
		(ii)	Define Grashof's law. State how it is helpful in classifying the four link mechanism in to different types.	**04**
	(b)	(i)	What is quick return mechanism? Where are they used?	**02**
		(ii)	Figure shows a six-link mechanism. The dimensions of the links are OA=100mm, AB=450mm, BD=200mm, QB=400mm, DE=200mm, CE=200mm. Find the angular velocity of the link CE by the instantaneous centre method if the link OA rotates at 20rad/s.	**05**



Q.2	**(a)**	(i)	What is pantograph? Show that it can produce paths exactly similar to the ones traced out by a point on an enlarged or reduced scale.	**03**
		(ii)	Derive an expression for the ratio of angular velocities of the shafts of a Hooke's joint.	**04**
	(b)		What is fundamental equation of steering gears? Which steering gear fulfills this condition?	**07**
			OR	
	(b)		How Rachet & Pawl mechanism works? Explain with neat sketch. What are the applications?	**07**
Q.3	**(a)**		What is displacement diagram? Why is it necessary to draw it before drawing a cam profile?	**07**

	(b)		Draw the profile of a roller reciprocating follower and with the following data: Minimum radius of cam = 25mm, Lift = 30mm Roller diameter = 15mm The cam lifts the follower for 120° with SHM follower by a dwell period of 30°. Then the follower down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150rpm, calculate the maximum velocity and acceleration of the follower during the descent period.	**07**
			OR	
Q.3	**(a)**		Deduce expression for the velocity and acceleration of the follower when it moves with simple harmonic motion.	**07**
	(b)		A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 25mm with SHM. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with SHM. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 30mm. Draw the profile of the cam.	**07**
Q.4	**(a)**	(i)	What are various kind of friction? Discuss each in brief.	**03**
		(ii)	What is a clutch? Make a sketch of a single- plate clutch and describe its working.	
	(b)		A screw jack is used to raise a load of 5 tones. The pitch of single-start squre threads used for the screw is 24mm. The mean diameter in is 72mm. Determine the force to be applied at the end of 1.2m long handle when the load is lifted with constant velocity and rotate with the spindle. Take μ=0.2. Also find the mechanical efficiency of the jack.	**07**
			OR	
Q.4	**(a)**	(i)	Make a comparison of cycloid and involute tooth forms.	**03**
		(ii)	What do you mean by a simple gear train and compound epicyclic gear? Explain with neat sketch.	**04**
	(b)	(i)	Two 20°involute spure gears having velocity ratio of 2.5 mesh externally. The module is 4mm and the addendum is equal to 1.23 module. The pinion rotates at 150rpm. Find the 1. Minimum number of teeth on each wheel to avoid interference, 2. Number of pairs of teeth in contact.	**05**
		(ii)	What do you mean by gyroscopic couple?	**02**
Q.5	**(a)**	(i)	What is a flywheel? What is it use?	**02**
		(ii)	Determine the energy released by a flywheel having a mass of 2kN and radius of gyration of 1.2m when its speed decreases from 460rpm to 435rpm.	**05**
	(b)	(i)	What is meant by static and dynamic unbalance in machinery? How can the balancing be done?	**04**
		(ii)	Explain the method of direct and reverse cranks to determine the unbalance forces in radial engines.	
			OR	
Q.5	**(a)**	(i)	What do you mean by primary and secondary unbalance in reciprocating engine?	**04**
		(ii)	What do you mean by force balancing of linkage? How is it achieved?	**03**
	(b)	(i)	What are free-body diagrams of mechanism? How are they helpful in finding the various members of the mechanism?	**03**
		(ii)	Derive an expression for the angular acceleration of the connecting rod of a reciprocating engine.	**04**

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