

GUJARAT TECHNOLOGICAL UNIVERSITY**B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012****Subject code: 142001****Date: 01/01/2013****Subject Name: Kinematics and Dynamics of Machines****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

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

- Q.1 (a)** In a four bar chain ABCD, link AD is horizontally fixed and the crank AB rotates at 10 rad/s clockwise uniformly. AB=60mm, BC=CD=70 mm, DA=120mm, angle DAB=60° and both 'B' & 'C' lie on the same side of AD. Find, (i) angular velocity of BC & CD, and (ii) angular acceleration of CD. Use graphical method. **07**
- (b)** Differentiate the following with suitable examples & neat sketches. **07**
(i) Lower & Higher pairs (ii) Closed & unclosed pairs (iii) Machine & Structure
- Q.2 (a)** A cam is to give the following motion to a knife-edged follower. **07**
(a) outstroke during 60° of cam rotation with SHM; (b) dwell for the next 30° of cam rotation; (c) return stroke during next 60° of cam rotation with uniform acceleration and retardation; (d) dwell for the remaining 210° of cam rotation. The lift of the follower is 40 mm and the minimum radius of cam is 50 mm. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.
- (b)** Explain the procedure to determine the velocity and acceleration of a slider crank mechanism using Klein's construction. State advantage of the same. **07**
- OR**
- (b)** State and explain Kennedy's theorem as applicable to Instantaneous centers of rotation of three bodies. Explain the procedure to locate I-centers of four bar mechanism. **07**
- Q.3 (a)** Give detailed classification of followers and explain each with neat schematic diagrams. **07**
- (b)** In a flat belt drive the initial tension is 2000 N. The coefficient of friction between the belt and the pulley is 0.3 and the angle of lap on the smaller pulley is 150°. The smaller pulley has a radius of 200 mm and rotates at 500 rpm. Find the power in kw transmitted by the belt. **07**
- OR**
- Q.3 (a)** State & explain Grashof's law. With suitable diagram, discuss how it is helpful in classifying the four link mechanisms into different types? **07**
- (b)** Explain different types of pulleys used in belt drives with suitable sketches. **07**
- Q.4 (a)** With neat schematic diagrams discuss the effect of gyroscopic couple on a naval ship during steering, pitching, and rolling. **07**
- (b)** A circular disc mounted on a shaft carries four attached masses 100 kg, 150 kg, 120 kg, 130 kg at radial distances 0.1 m, 0.075 m, 0.125 m, and 0.15 m respectively. The angles measured in anticlockwise direction between successive masses are 45°, 75°, and 135°. Find the position and magnitude **07**

of the balance mass required, at a radial distance of 0.1 m.

OR

- Q.4 (a)** The turbine rotor of a ship has a mass of 2200 kg and rotates at 1800 rpm clockwise when viewed from the aft (stern). The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple and discuss its effects when, (i) The ship turns right at a radius of 250 m with a speed of 25 km/hr. (ii) The ship pitches with the bow rising at an angular velocity of 0.8 rad/s. (iii) The ship rolls at an angular velocity of 0.1 rad/s. **07**
- (b)** Explain analytical and graphical method of balancing of different masses revolving in the same plane. **07**
- Q.5 (a)** Define vibration. With neat schematic diagrams explain free vibration, forced vibration, undamped vibration and damped vibration. **07**
- (b)** Two 20° gears have a module pitch of 4 mm. The number of teeth on gears 1 and 2 are 40 and 24 respectively. If the gear 2 rotates at 600 rpm, determine the velocity of sliding when the contact is at the tip of the tooth of gear 2. Take addendum equal to one module. Also, find the maximum velocity of sliding. **07**

OR

- Q.5 (a)** A spring-mass system has spring stiffness 'k', N/m and a mass of 'm', kg. It has natural frequency of vibration as 20 Hz. An extra 5 kg mass is coupled to 'm' and the natural frequency reduced by 3 Hz. Find the value of 'k' and 'm'. **07**
- (b)** With neat schematic diagrams explain different types of gear trains. **07**
