

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: X 21902**Date: 24/01/2013****Subject Name: Kinematics of Machines****Time: 10.30 am - 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.

- Q.1** (a) Show two inversions of slider crank mechanism and four bar mechanism each. **07**
- (b) Distinguish between **07**
- (i) Mechanism and machine
 - (ii) Kinematics and dynamics
 - (iii) Lower pair and higher pair
- Q.2** (a) OAB is slider crank mechanism. Crank OA = 150 mm, connecting rod AB = 600 mm, angle AOB = 45°. The crank rotates at constant angular velocity of 300 r.p.m. Find velocity and acceleration of midpoint M of connecting rod AB. **07**
- (b) ABCD is a four bar chain mechanism, the link dimensions are AB = 50 mm, BC = 66 mm, AD = 100 mm, CD = 56 mm. The crank AB rotates at constant angular velocity of 10.5 rad/sec in counter clockwise direction. Determine velocity of mid point M of the link BC by graphical method. Angle DAB = 60° **07**

OR

- (b) What is the Coriolis acceleration? In which cases does it occur? Derive an expression for the magnitude and direction of Coriolis component of acceleration. **07**
- Q.3** (a) What is centrifugal tension in the belt? Derive the equation to find the length of open belt. **07**
- (b) An open flat belt drive connects two parallel shafts 1.2 meters apart. The driving and the driven shafts rotate at 350 r.p.m. and 140 r.p.m. respectively and the driven pulley is 400 mm in diameter. The belt is 5 mm thick and 80 mm wide. The coefficient of friction between the belt and pulley is 0.3 and the maximum permissible tension in the belting is 1.4 MN/m². Determine:
1. diameter of the driving pulley,
 2. maximum power that may be transmitted by the belting, and
 3. Required initial belt tension.

OR

- Q.3** (a) Power is transmitted using a V-belt drive. The included angle of V-groove is 30°. The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg per metre length and maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140°. $\mu = 0.15$. **07**
- (b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? **07**

- Q.4 (a)** Derive an expression for the minimum number of teeth required on the pinion in order to avoid interference in involute gear teeth when it meshes with wheel. **07**
- (b)** Differentiate between Involute and Cycloidal gear tooth profile. Explain law of gearing. **07**

OR

- Q.4 (a)** A centrifugal clutch is to transmit 15 kW at 900 r.p.m. The shoes are four in number. The speed at which the engagement begins is $\frac{3}{4}$ th of the running speed. The inside radius of the pulley rim is 150 mm and the centre of gravity of the shoe lies at 120 mm from the centre of the spider. The shoes are lined with Ferrodo for which the coefficient of friction may be taken as 0.25. Determine : 1. Mass of the shoes, and 2. Size of the shoes, if angle subtended by the shoes at the centre of the spider is 60° and the pressure exerted on the shoes is 0.1 N/mm². **07**
- Q.4 (b)** Derive an expression for the torque transmitted by a single plate clutch assuming (i) Uniform pressure theory (ii) Uniform wear theory. **07**
- Q.5 (a)** Define and explain with neat sketch Base circle , Prime circle , Pressure angle , Pitch curve and Pitch point related to cam and follower. **07**
- (b)** Derive maximum efficiency of screw jack. **07**

OR

- Q.5 (a)** Classify cams and followers with figure. **07**
- (b)** Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam. **07**
