

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (Old) EXAMINATION – WINTER 2019

Subject Code: 142001
Date: 13/12/2019
Subject Name: Kinematics And Dynamics 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.

- Q.1** (a) Classify the types of cam followers with neat sketch. **07**
 (b) Sketch & explain various inversions of four bar chain mechanism. **07**
- Q.2** (a) Differentiate the following with suitable example & neat sketches. **07**
 (I) Lower & Higher Pairs (II) Closed & unclosed pairs
 (III) Machine & Structure
- (b) A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190° , both being measured in same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, Determine: (1) The magnitude of the masses at A and D (2) The distance between planes A and D and (3) The angular position of mass at D. **07**
- OR**
- (b) By using Klein's construction method, explain the procedure to determine velocity and acceleration of a slider crank mechanism. **07**
- Q.3** (a) Define contact ratio and derive an equation for length of path of contact for involute gears. **07**
 (b) Derive the condition for maximum power transmitted by a belt drive considering the effect of centrifugal tension. **07**
- OR**
- Q.3** (a) Explain different types of flat belt drives with neat sketches. **07**
 (b) A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 r.p.m. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions: **07**
 1. The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius.
 2. The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds.
 3. The ship rolls and at a certain instant it has an angular velocity of 0.03 rad/s clockwise when viewed from stern.
 Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.
- Q.4** (a) State the law of gearing and Define the following gear terminologies with suitable sketch. (i) Pitch circle (ii) Module (iii) Addendum (iv) Pressure angle **07**
 (b) A cam is to give the following motion to a knife-edged follower : **07**
 (i) Dwell for the next 30° of cam rotation.
 (ii) Dwell for the next 30° of cam rotation.

(iii) Return stroke during next 60° of cam rotation and
 (iv) Dwell for the remaining 210° of cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

OR

- Q.4 (a)** Explain the effect of gyroscopic couple on a naval ship during steering. **07**
(b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; PS = 200 mm . The crank PQ rotates at 10 rad/s clockwise. Draw the Velocity and Acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular Acceleration of links QR and RS. **07**

- Q.5 (a)** Classify various gear trains and explain Reverted gear train with neat sketch. **07**
(b) Four masses m_1 , m_2 , m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45° , 75° and 135° . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. **07**

OR

- Q.5 (a)** Define Free vibration and Force Vibration. Determine Natural Frequency of Free Longitudinal Vibrations system. **07**
(b) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? **07**
