

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-IV Examination-Nov/Dec-2011

Subject code: 141902

Date: 30/11/2011

Subject Name: Kinematics Of machines

Time: 02.30 pm -5.00 pm

Total marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Illustrate your answer with neat sketches wherever required.

- Q.1** (a) Derive the expression for limiting tension ratio in case of flat belt drive. **07**
(b) Derive the expression for the frictional torque of a flat pivot bearing assuming (i) Uniform pressure theory (ii) Uniform wear theory. **07**

- Q.2** (a) Two shafts whose centres are 1 m apart are connected by a V-belt drive. The driving pulley is supplied with 100 kW and has an effective diameter of 300 mm. It runs at 1000 r.p.m. while the driven pulley runs at 370 r.p.m. The angle of groove on the pulleys is 40° . The permissible tension in 400 mm^2 cross-sectional area belt is 2.1 MPa. The density of the belt is 1100 kg/m^3 . The coefficient of friction between the belt and pulley is 0.28. Estimate the number of belts required. **07**

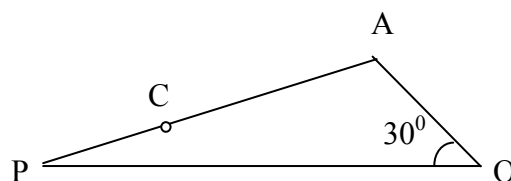
- (b) Determine the percentage increase in power capacity made possible in changing over from a flat pulley to a V belt drive. The diameter of the flat pulleys is the same as the pitch circle diameter of the V belt grooved pulleys. The pulley rotates at the same speed as the grooved pulley. The belt materials are the same and they have the same cross sectional area, with coefficient of friction for both as 0.3. The groove angle of the V belt pulley is 60° and the angle of contact for both the cases is 150° . **07**

OR

- (b) What are different types of chains? Explain with neat sketches, the power transmission chains. **07**

- Q.3** (a) Define: Kinematic link, Kinematic pair, Kinematic chain. **04**

- (b) Following data relates to reciprocating steam engine as shown in fig. Uniform speed of crank = 240 rpm
Radius of crank = 150 mm
Length of connecting rod between center = 600 mm
Direction of rotation of crank is clockwise. When the crank has turned 30° from I.D.C. Find:
(1) Acceleration of piston
(2) Acceleration of C.G. of connecting rod, C.G. being 200 mm from big end centre. **10**



OR

[P.T.O.]

- Q.3 (a)** What are quick return motion mechanisms? Where they are used? Discuss the functioning of any one of them. **07**
- (b)** What is the condition for correct steering? Sketch and explain any one type of steering gear mechanism with its advantages. **07**
- Q.4 (a)** Explain what is meant by the term “Interference” as related to toothed gears having profile? Discuss various methods used to avoid interference. **05**
- (b)** An epicyclic train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B which drives wheel D through and idle wheel C, wheel D being concentric with A. Wheels B and C are carried on an arm E which revolves clockwise at 100 r.p.m. about the axis of A and D. If the wheel B and D have 25 and 40 teeth respectively, find the number of teeth on C and sense of rotation of C. Also sketch the arrangement. **09**
- OR**
- Q.4 (a)** Write a short note on centrifugal clutch. **05**
- (b)** A multiple disc clutch transmits 75 kW of power at 2000 rpm. Coefficient of friction for the friction surfaces is 0.2. Axial intensity of pressure is not to exceed 180 kN/m². Internal radius is 100 mm and is 0.8 times the external radius. Find the number of plates needed to transmit the required torque. Assume uniform wear conditions. **09**
- Q.5 (a)** Define the following terms related to cam. **04**
- (i) Base circle
(ii) Pitch circle
(iii) Pressure angle
(iv) Stroke of the follower
- (b)** Draw the profile of a cam operating a roller follower of 30 mm diameter from the following data: **10**
- (i) It lifts the follower through 50 mm during 90° rotation with S.H.M.
(ii) The follower remains at rest for next 30° of cam rotation.
(iii) The follower is then descent to its original position during 60° of cam rotation with uniform acceleration and retardation.
(iv) It remains at rest for the rest of cam rotation.
- Least radius of cam is 50 mm. If it rotates at 300 rpm, find maximum velocity and acceleration during ascent and descent.
- OR**
- Q.5 (a)** Explain with the neat sketch the “sun and planet wheel”. **04**
- (b)** In a tangent cam operating a roller follower the following data are given : **10**
- Base circle radius = 25 mm, Roller radius = 10 mm, Angle of ascent = 75°, Total lift = 20 mm, Speed of the cam shaft = 600 rpm.
- Calculate: (1) The dimensions of the cam (2) The acceleration of the follower (a) at the beginning of the lift (b) when the roller is at beginning of nose radius (c) when the follower is at apex of the circular nose.