

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- IVth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 142001****Date: 02/06/2012****Subject Name: Kinematics & Dynamics 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) What is Pentograph? Explain its function & Applications. **07**
 (b) Explain: Completely, incompletely and successfully constrained motions with neat sketch. **07**

- Q.2** (a) The dimensions and configuration of the four bar mechanism, shown in 2.1, The angle $\angle AP_1P_2 = 60^\circ$. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s^2 , both clockwise. Determine the angular velocities and angular accelerations of P_2B , and AB and the velocity and acceleration of the joint B. **07**

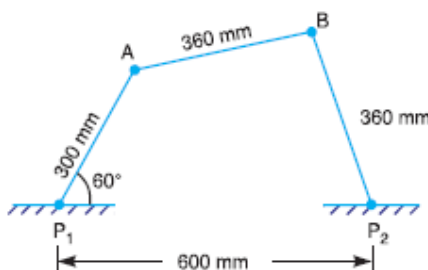


Figure 2.1

- (b) In the mechanism, as shown in Fig. 2.2, the crank OA rotates at 20 rpm anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are $OA = 300 \text{ mm}$; $AB = 1200 \text{ mm}$; $BC = 450 \text{ mm}$ and $CD = 450 \text{ mm}$. For the given configuration, determine: 1. velocities of sliding at B and D, 2. Angular velocity of CD, 3. linear acceleration of D, and 4. angular acceleration of CD. **07**

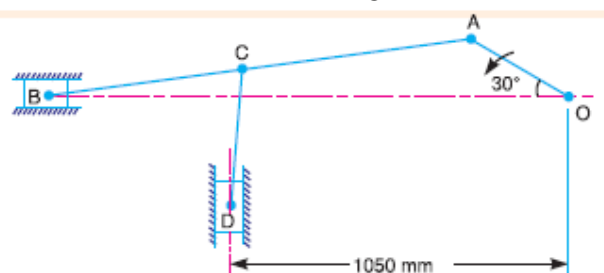


Figure 2.2

OR

- (b) An open belt drive connects two pulleys 1200 mm and 500 mm diameter, on parallel shafts 4 meters apart. The mass of the belt is 0.9 Kg per meter length and the maximum tension is not to exceed 2 KN. The coefficient of friction is 0.3. The 1200 mm diameter pulley, which is driver, runs at 200 rpm. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 rpm. Calculate the torque on each of the shafts, the power transmitted and power lost in friction. What is the efficiency of the drive? **07**
- Q.3** (a) Derive an expression for length of open belt drive. **07**
- (b) A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm is in mesh. The smaller gear rotates at 1000 rpm. Determine: 1. Sliding velocities at engagement and at disengagement of pair of a teeth, and 2. contact ratio. **07**
- OR**
- Q.3** (a) Explain the effect of gyroscopic couple on naval ship. **07**
- (b) Classify gear trains. Give suitable application of each type of gear train. Explain with neat sketch sun and planet type gear. **07**
- Q.4** (a) A cam running at a uniform speed in clockwise direction has a knife edge reciprocating follower; **07**
 Draw the profile of the cam to the following specifications:
 a) Follower to move outward through a distance of 30 mm during 150 degrees of cam rotation;
 b) Follower to dwell for 50 degree of cam rotation;
 c) Follower to return to its initial position during 70 degree of cam rotation;
 d) Follower to dwell for the remaining degrees of cam rotation;
 The line of stroke of the follower is offset 15 mm from the axis of the cam and displacement of the follower is to taken place with uniform acceleration and retardation during the outward stroke and with SHM during return stroke.
- (b) A cam drives a flat reciprocating follower: during first 90° rotations of the cam, follower moves outwards through a distance of 3 cm with SHM. The follower dwells during next 90° cam rotation. During next 90° cam rotation, the follower moves outwards with SHM. Follower dwells for the remaining cam rotation. Draw cam profile. **07**
- OR**
- Q.4** (a) An aeroplane makes a complete half circle of 50 meters radius, towards left, when flying at 200 kmph. The rotary engine and the propeller of the plane have a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 rpm clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it. **07**
- (b) A cam drives a flat reciprocating follower: during first 90° rotations of the cam, follower moves outwards through a distance of 3 cm with SHM. The follower dwells during next 90° cam rotation. During next 90° cam rotation, the follower moves outwards with uniform velocity. Follower dwells for the remaining cam rotation. Draw cam profile. **07**

- Q.5** (a) Differentiate between static and dynamic balancing. **07**
- (b) A shaft carries four masses in parallel planes P, Q, R and S in this order along its length. The masses at Q and R are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at P and S have an eccentricity of 80 mm. The angle between the masses at Q and R is 100° and that between the masses at Q and P is 190° , both being measured in the same direction. The axial distance between the planes P and Q is 100 mm and that between Q and R is 200 mm. If the shaft is in complete dynamic balance, determine: 1. the magnitude of the masses at P and S; 2. the distance between planes P and S; and 3. the angular position of the mass at S. **07**

OR

- Q.5** (a) Explain the terms i) Natural frequency, ii) Damping, **07**
 iii) logarithmic decrement iv) Vibration isolation
- (b) Find the natural frequency of the system shown below. **07**

