

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – WINTER • 2014****Subject Code: 142001****Date: 05-01-2015****Subject Name: Kinematics and Dynamics of Machines****Time: 02:30 pm - 05:00 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)** Enlist various inversions of Simple slider crank chain & explain Crank and slotted lever quick return motion mechanism with neat sketch. **07**
- (b)** Distinguish Completely constrained, Incompletely constrained and Successfully constrained motion with neat sketch. **07**

- Q.2 (a)** Classify the various types of follower according to surface contact and motion of the follower with neat sketch. **07**
- (b)** Draw the profile of a cam operating a **roller reciprocating follower** with the following data: **07**
- Minimum radius of cam = 30 mm, Lift = 40 mm, Roller diameter = 15 mm
The cam lifts the follower for $1/3^{\text{rd}}$ rotation of cam with **SHM** followed by a dwell period for next $1/12^{\text{th}}$ rotation of cam. Then the follower lowers down during $5/12^{\text{th}}$ rotation of the cam rotation with **uniform velocity** followed by a dwell period.

OR

- (b)** A cam is to give the following motion to a **knife-edge follower**: **07**
- Outstroke during 60° of cam rotation
Dwell for the next 30° of cam rotation
Return stroke during next 90° of cam rotation & Dwell for the remaining 180° of cam rotation. The stroke of the follower is 40 mm and minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower is offset by 20 mm from the axis of the cam shaft. What will be the maximum velocity and acceleration of the follower during the lift and return, If the cam rotates at 200 rpm?
- Q.3 (a)** Explain the following terms briefly for naval ship: Steering, Pitching & Rolling. **07**
- (b)** A shaft carries four masses in parallel planes A, B, C and D in this order along its length. **07**
- 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.

OR

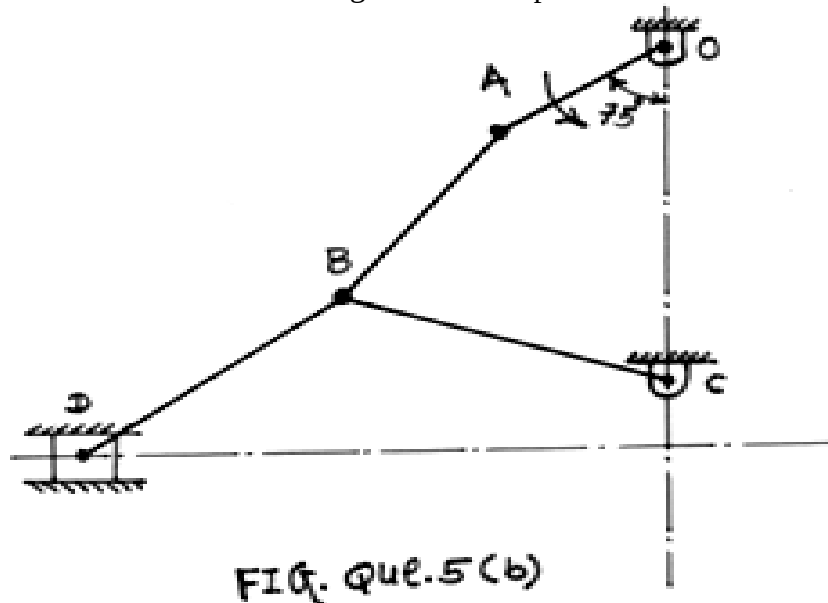
- Q.3 (a)** Define the terms “Static balancing” and “Dynamic balancing”. State the necessary conditions to achieve them. **07**

- (b) A ship propelled by a turbine rotor which has a mass of 7 tonnes and a speed of 1800 r.p.m. The rotor has a radius of gyration of 0.6 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 25 km/hr and steers to the left in a curve having 50 m radius. (2) The ship pitches 6° above and 6° below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is SHM and the periodic time is 20 seconds.
- Determine** also the max. Angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case.

- Q.4 (a) Explain briefly: "Law of gearing" **07**
- (b) **Define** contact ratio and derive an equation for length of path of contact for involute gears. **07**

OR

- Q.4 (a) Explain the following terms (1) Natural frequency, (2) Damping factor, (3) logarithmic decrement, (4) Vibration isolation **07**
- (b) Enlist different types of gear train and explain compound gear train with suitable example. **07**
- Q.5 (a) Explain centrifugal tension and derive an equation for the maximum power transmission in belt drive. **07**
- (b) The mechanism, as shown in figure, the angular velocity of the crank OA is 600 r.p.m. **07**
- Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are: OA = 28 mm; AB = 44 mm; BC = 49 mm; and BD = 46 mm. The centre distance between the centers of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.



OR

- Q.5 (a) A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is 30° . The cross-sectional area of each belt is 750 mm^2 and $\mu = 0.12$. The density of the belt material is 1.2 Mg/m^3 and the maximum safe stress in the material is 7 Mpa. Calculate the power that can be transmitted between pulleys 300 mm diameter rotating at 2000 r.p.m. Find also the shaft speed in r.p.m. at which the power transmitted would be maximum. **07**
- (b) Define straight line mechanism. Explain Hart's straight line mechanism with neat sketch. **07**
