

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3142006

Date:24-01-2024

Subject Name:Analysis of Mechanisms

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.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1**
- (a) Define: Kinematic Link, Kinematic Pair, Kinematics **03**
  - (b) Define Degree of Freedom. Explain its importance in mechanisms. **04**
  - (c) For the kinematic linkage shown in Fig.1 , Calculate **07**
    - (1)number of binary,ternary links etc.
    - (2)number of total links
    - (3)number of loops,joints or pairs,degree of freedom

- Q.2**
- (a) Draw any two inversions of four bar chain. **03**
  - (b) Classify the kinematic pairs based on nature of contact giving examples. **04**
  - (c) The mechanism, as shown in Fig. 2 has the dimensions of various links as follows :AB = DE = 150 mm ; BC = CD = 450 mm ; EF = 375 mm. The crank AB makes an angle of  $45^\circ$  with the horizontal and rotates about fixed point A in the clockwise direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the fixed point D, which is connected to AB by the coupler BC. The block F moves in the horizontal guides, being driven by the link EF. Determine: 1. velocity of the block F, 2. angular velocity of DC. **07**

**OR**

- (c) In Fig. 3, the angular velocity of the crank OA is 600 r.p.m. 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  $75^\circ$  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 centres 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. **07**
- Q.3**
- (a) Explain transverse and torsional vibrations giving examples. **03**
  - (b) What are the types of followers? Explain with neat sketch. **04**
  - (c) Classify the gears giving neat sketches. **07**

**OR**

- Q.3**
- (a) What are the effects of vibrations? Explain. **03**
  - (b) What are the types of clutches? **04**
  - (c) Classify the brakes giving neat sketches. **07**
- Q.4**
- (a) What are the causes of unbalance? Explain. **03**
  - (b) State and explain governing equation of single degree of freedom system of spring and a mass. **04**
  - (c) The centre distance between two spur gears in a mesh is to be approximately 275 mm. The gear ratio is 10 to 1. The pressure angle of involute teeth is  $20^\circ$  and addendum is equal to one module. Find (1)the nearest standard **07**

module so that interference does not occur (2) the number of teeth on each gear wheel.

OR

- Q.4 (a) What are the effects of unbalance? Explain. 03  
 (b) What are the types of gears used for different shaft axes configurations? 04  
 (c) A shaft supported in bearings that are 1.6 m apart projects 400 mm beyond bearings at each end. It carries three pulleys one at each end and one at centre of its length. The masses of the end pulleys are 40 kg and 22 kg and their centres of masses are at 12 mm and 18 mm respectively from shaft axes. The mass of centre pulley is 38 kg and its centre of mass is 15 mm from the shaft axis. The pulleys are arranged in a manner that they give static balance. Determine (i) the relative angular positions of the pulleys (ii) dynamic forces developed on the bearings when the shaft rotates at 210 rpm. 07
- Q.5 (a) Classify the pulleys according to their applications. 03  
 (b) Derive an equation for length of belt in open belt drive. 04  
 (c) Discuss the gyroscopic effects in two wheeler taking right and left turn. 07

OR

- Q.5 (a) Explain: Axis of precession, plane of spin with neat sketches. 03  
 (b) Briefly discuss the gyroscopic effects on air plane taking right turn. 04  
 (c) Derive an equation for maximum power transmission in belt drive. 07

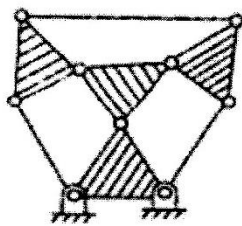


Fig.1, Q 1(b)

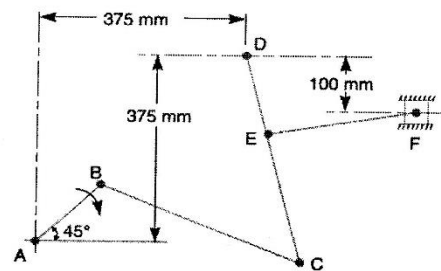


Fig.2, Q 2(c)

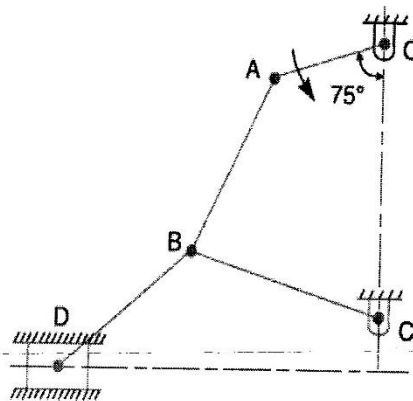


Fig.3, Q.2 (c) OR

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