

# GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2142001

Date: 13/12/2019

Subject Name: Kinematics & 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.

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q.1       | (a) What is the difference between machine, mechanism, and structure?                                                                                                                                                                                                                                                                                                                                                                                            | 3     |
|           | (b) Determine all possible I- centers of Four bar mechanisms.                                                                                                                                                                                                                                                                                                                                                                                                    | 4     |
|           | (c) Explain different Kinematic Pairs with suitable examples.                                                                                                                                                                                                                                                                                                                                                                                                    | 7     |
| Q.2       | (a) State and explain Types of Constrained Motion with figure.                                                                                                                                                                                                                                                                                                                                                                                                   | 3     |
|           | (b) What is active and reactive gyroscopic couple? Give the practical application in which gyroscopic principal is observed.                                                                                                                                                                                                                                                                                                                                     | 4     |
|           | (c) A quick return mechanism is shown in the <b>Fig.1</b> . Link 2 rotates at 25 rad/sec. Draw the velocity and acceleration diagram. Take OA = 145 mm, OC = 345 mm, BC = 245 mm.                                                                                                                                                                                                                                                                                | 7     |
| <b>OR</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |
|           | (c) In a four bar chain ABCD, AD is fixed link. Crank AB rotates in clockwise direction at an angular velocity of 10 red/sec. Link AB = 55 mm, BC = CD = 65 mm, DA = 15 mm. when angle DAB = 55° and the points B and D are on one side of the link AD, Find angular velocity of link BC and link CD.                                                                                                                                                            | 7     |
| Q.3       | (a) Derive the expression for tension ratio of flat belt drive.                                                                                                                                                                                                                                                                                                                                                                                                  | 3     |
|           | (b) Explain the different kind of pulley arrangements of belt drives with their applications.                                                                                                                                                                                                                                                                                                                                                                    | 4     |
|           | (c) 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 200rev/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? | 7     |
| <b>OR</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |
| Q.3       | (a) Explain the phenomena of 'slip' and 'creep' in a belt drive.                                                                                                                                                                                                                                                                                                                                                                                                 | 3     |
|           | (b) Discuss the effect of gyroscopic couple on naval ship.                                                                                                                                                                                                                                                                                                                                                                                                       | 4     |
|           | (c) Explain with a neat sketch the "Sun and Planet wheel". Write its merits and demerits as compared to reverted and compound gear trains.                                                                                                                                                                                                                                                                                                                       | 7     |
| Q.4       | (a) What are the different types of motion with which a follower can move?                                                                                                                                                                                                                                                                                                                                                                                       | 3     |
|           | (b) Define the following terms as applied to cam with a neat sketch: (a) Base circle (b) Pitch circle (c) Pressure angle and (d) Stroke of the follower.                                                                                                                                                                                                                                                                                                         | 4     |
|           | (c) A spring mass damper system has a mass of 4 kg, a stiffness of spring is 300 N/m and damping coefficient of 35N sec/m. Determine: (1) Natural frequency of damped vibration, (2) Natural frequency of the system, if instead of viscous damping dry friction damping is present.                                                                                                                                                                             | 7     |

- Q.4 (a) State the advantages of helical gear over spur gear. 3  
(b) What are the different forms of gear tooth? Explain any one form in detail. 4  
(c) The four masses  $m_1$ ,  $m_2$ ,  $m_3$  and  $m_4$  having their radii of rotation as 180 mm, 140 mm, 230 mm and 290 mm are 210 kg, 310 kg, 245 kg and 265 kg in magnitude respectively. The angles between the successive masses are  $45^\circ$ ,  $75^\circ$ , and  $135^\circ$  respectively. Find the position and magnitude of the balance mass required, if its radius of rotation is 210 mm. 7

- Q.5 (a) Distinguish between longitudinal, transverse and torsional vibration. 3  
(b) The measurements on a mechanical vibrating system shows that it has a mass of 9 kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/mm. If the vibrating system has a dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s, find the (1) critical damping coefficient (2) damping factor (3) logarithmic decrement (4) ratio of two consecutive amplitudes. 4  
(c) What do you understand by degree of freedom? What are the various causes of vibrations? How the effects of undesirable vibrations can be reduced? 7

OR

- Q.5 (a) What do you mean by damping? What are the various types of damping? 3  
(b) Define following terms: (1) Simple harmonic motion (2) Time period (3) Frequency (4) Amplitude 4  
(c) The following data relate to a cam profile in which the follower moves with SHM during ascent and with uniform acceleration and deceleration during descent. Minimum radius of cam = 30 mm, roller diameter = 30 mm, lift of follower = 35 mm, offset of follower axis = 15 mm towards right, angle of ascent =  $115^\circ$ , angle of descent =  $145^\circ$ , angle of dwell between ascent and descent =  $50^\circ$ , speed of the cam = 180 rpm. Draw the profile of the Cam. 7

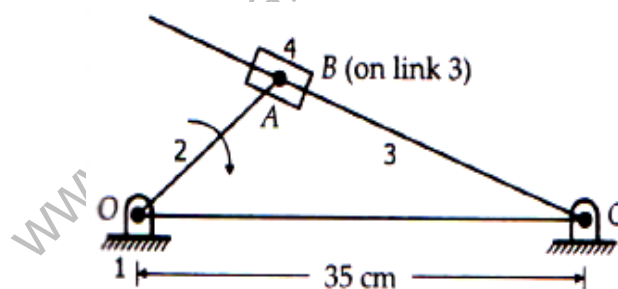


Fig.1

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