Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech., Winter 2017 - 18 Examination

Semester: 1 **Date: 30/12/2017**
Subject Code: 03217103 **Time: 02:00 pm to 04:30pm**
Subject Name: Kinematics and Dynamics of Machinary **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) Define mobility and explain criterion of Gruebler and Kutzback with reference to it. **(05)**
B) Using Energy Method and Rayleigh Method prove $\omega = \sqrt{k/m}$ **(05)**
C) Explain algebraic solution approach using inverse kinematics for coordinate frame assignment for planer manipulator. **(05)**

Q.2 **Answer the following questions. (Attempt any three)** **(15)**
A) Derive differential equation of motion for single degree of freedom using Newton's method.
B) Short note on Inverse Kinematics.
C) Explain Graphical method for determining three precision points.
D) Enlist methods of velocity analysis of mechanism and Explain relative velocity method.

Q.3 A) Define function Generation and Prove freudenstein's equation for four bar mechanism. **(07)**
B) Design a four link mechanism to coordinate three positions of the input and output links as follow: **(08)**

$\theta 1 = 20°, \theta 2 = 35°, \theta 3 = 50°$ and $\emptyset 1 = 35°, \emptyset 2 = 45°, \emptyset 3 = 60°$

OR

B) Using Holzer Method find the natural frequencies of the system shown in figure1, Assume $m_1 = m_2 = m_3 = 1$kg and $k_1 = k_2 = k_3 = 1$N/m. **(08)**

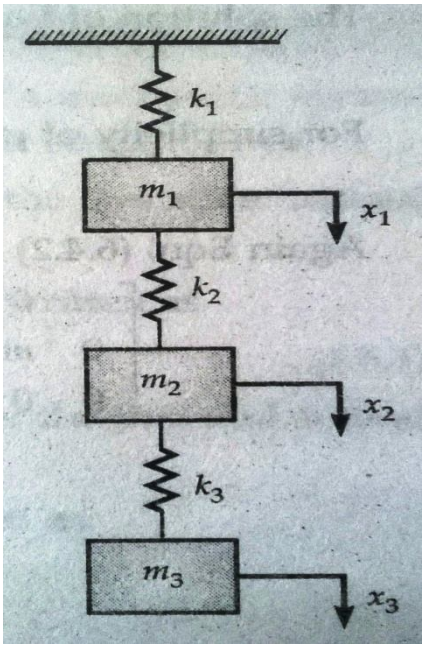

Fig 1: Spring Mass System

Q.4 A) A quick return mechanism of the crank and slotted lever type shaping machine is shown in Fig 2. The dimensions of the various links are as follows : O_1O_2=800mm;O_1B=300mm;O_2D=1300mm;DR=400mm and the crank O_1 B makes an angle of 45° with the vertical and rotates at 40 r.p.m. in the counter clockwise direction. Find: 1. velocity of the ram R, or the velocity of the cutting tool, and 2. angular velocity of link O2D. **(07)**

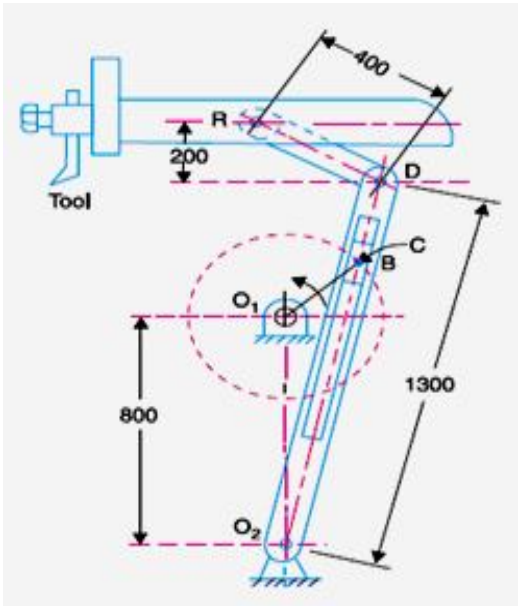

Fig 2: Quick return mechanism

OR

A) A four bar mechanism has following dimension : **(07)**
DA=300mm,CB=AB=360mm,DC=600mm.The link DC is fixed and the angle ADC is 60^O.The driving link DA rotates uniformly at a speed of 100 r.p.m clockwise and the constant driving torque has the magnitude of 50 N-m. Determine the velocity of the point B and angular velocity of the driven link CB .Also find the actual Mechanical Advantage and resisting torque if efficiency of the mechanism is 70%.

B) A four bar mechanism is to be designed by using three precision points to generate the function $y=x^{1.5}$ for the range of $1 \leq x \leq 4$.Assuming 30^O starting position and 120^O finishing position for the input link and 90^O starting position and 180^O finishing position for the output link .Find the values of x, y,θ and Φ corresponding to three precision points. **(08)**