Student Exam. No.________

GANPAT UNIVERSITY

M. TECH. SEM.- I (CAD/CAM) MECHANICAL ENGINEERING
REGULAR EXAMINATION NOV/DEC. 2016
(3ME113) Advanced Kinematics & Dynamics of Machines

Time: 3 Hours **Total Marks: 60**

Instructions:

(1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Assume suitable data if required.
(4) Only scientific calculator is allowed.

SECTION - I

Que.1

(a) Write the objective of kinematics and dynamics of machines. Explain the kinematics and dynamics as a part of the design process using proper illustration. [5]

(b) Explain the mobility of mechanisms with suitable sketches in detail. [5]

OR

Que. 1

(a) How many degree of freedom would three links connected by revolute joints at point B (see Fig. 1) have? Prove. [3]

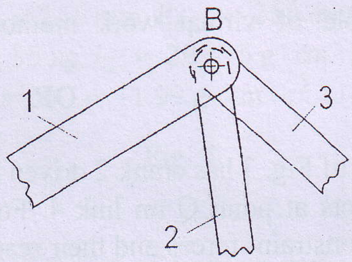


Fig. 1

(b) An adjustable slider drive mechanism consists of a crank-slider with an adjustable pivot, which can be moved up and down (see Fig. 2). [7]

1. How many bodies (links) can be identified in this mechanism?
2. Identify the type (and corresponding number) of all kinematic joints.
3. What is the function of this mechanism and how will it be affected by moving the pivot point up and down?

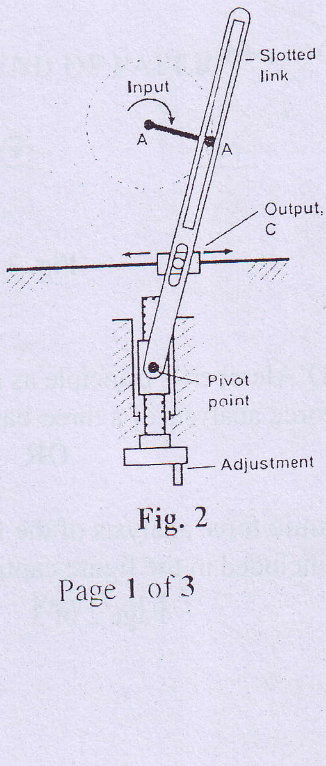


Fig. 2

Que. 2

(a) Explain the graphical position analysis of four bar linkage using net sketches. [5]

(b) Explain the position of any point on a linkage using proper illustration and usual notations. [5]

OR

Que. 2

(a) Explain the method of calculating the input link angel which corresponds to the toggle positions of the non-Grashof fourbar linkage. [5]

(b) In which situation you will go for the application of Newton-Raphson solution method? Explain the one-dimensional root-finding method. [5]

Que. 3

(a) Define the Kennedy's rule for instant centers of velocity. Explain the method of finding all instant centers for a fourbar linkage. [5]

(b) Explain the angular velocity ratio, effective link pairs, principle of transmissibility using proper illustration. [5]

SECTION - II

Que. 4

(a) Explain friction consideration in slider-crank mechanism with four possible ways of drawing a tangent to friction circle. [5]

(b) Explain the principle of virtual work method for static force analysis with neat sketch. [5]

OR

Que. 4

The four bar linkage of Fig. 3 has crank 2 driven by an input torque M_{12}; an external load $P = 534 \angle 220°$ N acts at point Q on link 4. For the particular position of the linkage shown, find all the constraint forces and their reactions necessary for this to be a position of equilibrium using analytical method. [10]

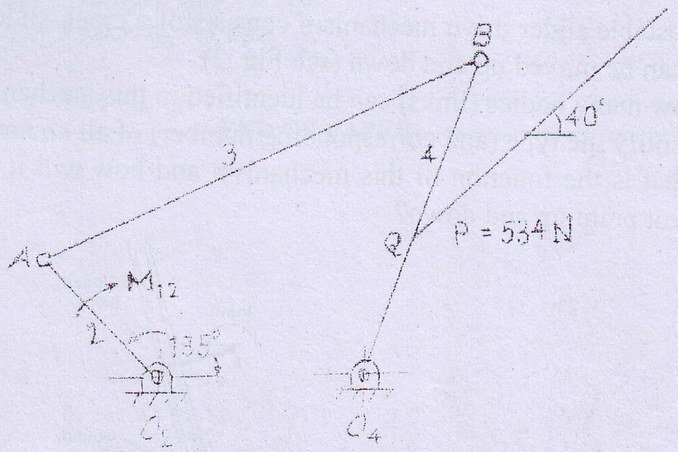


Fig. 3

Que. 5

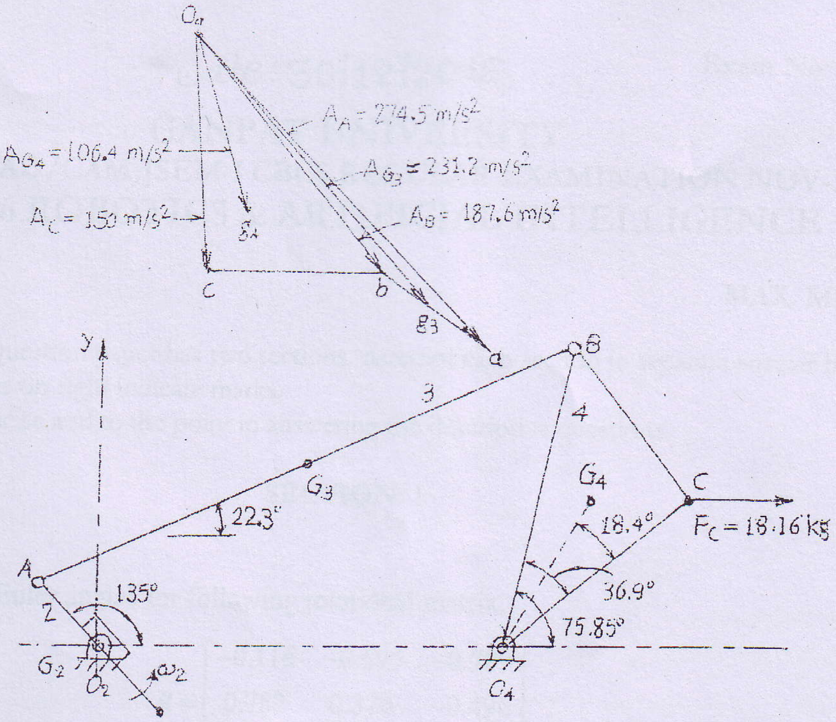
(a) State and explain the D'Alembert's principle as applied to dynamic force analysis. [5]

(b) Explain the dynamic force analysis of a three-bar crank-slider linkage with neat sketches. [5]

OR

Que. 5

Make a complete dynamic force analysis of the four-bar linkage illustrated in Fig. 4. The known information is included in the figure caption. [10]



$R_{AO_2} = 75\ mm, R_{O_4O_2} = 350\ mm, R_{BA} = 500\ mm, R_{BO_4} = 250\ mm$
$R_{CO_4} = 200\ mm, R_{CB} = 150\ mm, R_{G_3A} = 250\ mm, R_{G_4O_4} = 142.25\ mm$
$w_3 = 3.23\ kg, w_4 = 1.55\ kg, I_{G_2} = 283.75\ g \cdot cm \cdot s^2$
$I_{G_3} = 709.37\ g \cdot cm \cdot s^2, I_{G_4} = 41.99\ g \cdot cm \cdot s^2, \omega_2 = 60\ rad/s, \alpha_2 = 0$

Fig. 4.

Que. 6

(a) What do you understand by two degree of freedom system? Explain the general rule for the computation of the number of degrees of freedom of the system. Explain the motor-pump system on springs and packaging of an instrument as two degree of freedom system with suitable sketches. [5]

(b) Derive the characteristic equation for a viscously damped two degree of freedom spring-mass system. [5]

********END OF PAPER********