MER312 Fall 2016 Exam II ReWrite Cover Sheet

As a student at Union College, I am part of a community that values intellectual effort, curiosity, and discovery. I understand that in order to truly claim my educational and academic achievements, I am obligated to act with academic integrity. Therefore, I affirm that I carried out this assignment with full academic honesty, and I rely on my fellow students to do the same.

For this Exam ReWrite, I understand that:

1. I **must** work alone in writing out the solutions to the problems in this exam.
2. Once I start solving a problem in the ReWrite exam I **must** complete the problem without taking any breaks including all additional steps assigned to the problem.
3. I **cannot** copy solutions, in part or whole, to the problem on this exam from any person or resource.
4. Prior to writing the exam problem as stipulated in 2 above, it is completely acceptable to use any resource (instructor, book, person, web, etc) to seek out help in formulating a solution to the problem.
5. I **cannot** use any electronic resources to assist me in the solution to the questions on this exam while I am writing the exam problem as stipulated in 2 above except for the computer programs that I developed in this course and my calculator except for the purpose of performing appropriate calculations for this exam.
6. Because I am being allowed to use my own computer to solve problems on this exam, I **can** only have the program that I developed as part of this course running on my computer during the exam. I **cannot** have any other programs running while I am writing my solution as stipulated in 2 above, this is meant to include email, web browsers, etc.
7. I **can** use one page - single sided - of notes during the exam. This one page of notes **cannot** contain any solutions to problems. I must staple this page to the back of my exam at the end of the exam.
8. When I turn in my exam for grading,
    a. The ReWritten exam problems and all their parts must be in order, and
    b. The original exam must be stabled behind the ReWritten exam.
9. I understand that if the additional steps assigned to the problem are not completed and turned in with the ReWrite, the problem will not be graded.
10. I understand that I can solve as many problems on the exam as I wish and that I will receive up to half of the points I lost on the original exam back depending on the correctness of the ReWrite solution.

Signature: _____

Print Name: _____

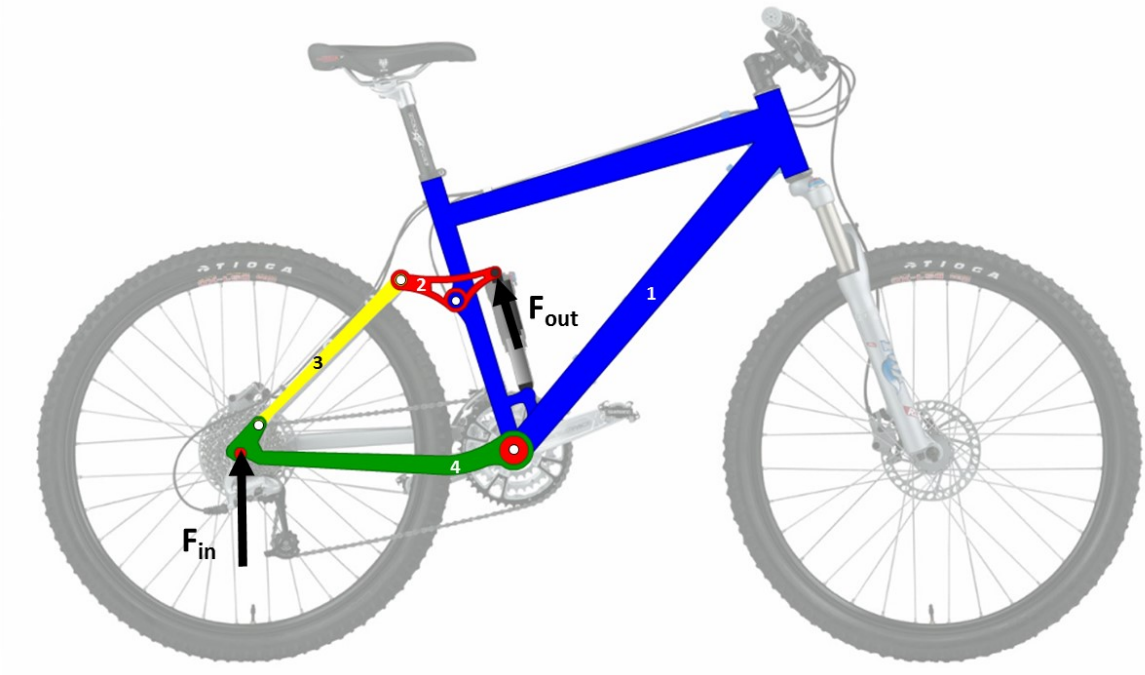
Due Date: _____

MER312 Exam II ReWrite Instructions

For each of the problems on the Exam ReWrite, additional steps are assigned to the problems that must be completed for the work to be considered for grading. Below are the instructions for the additional steps needed for each problem on the exam.

1. Solve Problem 1, in addition
    a. If the tire hits a bump and the input linear velocity where the force is applied is 2 in/s relative to the frame, what is the linear velocity of the shocks compression with respect to the frame?
    Given the distance from I_{14} to where F_{in} is applied is 14 in.
    b. What are the angular velocities of links 2, 3, and 4?
2. Solve Problem 2, in addition
    a. Determine the angular velocities of links 3, 4, and 5.
    b. Determine the linear velocity of the joint where links 4 and 5 connect.
    c. Determine the relative linear velocity of link 3 with respect to I_{14}.
3. Solve Problem 3, in addition
    a. Construct the device in SolidWorks given AB=1.5ft.
    b. Using SolidWorks Motion, a motor that rotates at 2 rev/min, for one cycle
        i. plot the Paths of points A and B,
        ii. plot the magnitude of the velocity of points A, B, and where the drive dyad attaches to the mechanism as a function of time, and
        iii. plot the magnitude of the angular velocity of AB as a function of time for one cycle.
4. Solve Problem 4, in addition
    a. Draw the mechanism to scale in the described orientation,
    b. Determine all instant centers associated with the mechanism for the configuration shown,
    c. Calculate the linear velocities of points A, B, and P using instant centers, and compare them with your program, and
    d. Calculate the angular velocities of links 3 and 4 using instant centers and compar them with your program.

PROBLEM 1: A shock is being designed for the bike below. The frame can be considered the ground link and the other links are numbered. The direction and location of the input force F_{in} is shown on the drawing along with the location and direction of the output Force F_{out}.



1a. Determine the Mechanical Advantage of this system. Use the figure above for the construction of the relevant features that will allow you to calculate the mechanical advantage. Write all calculations below.

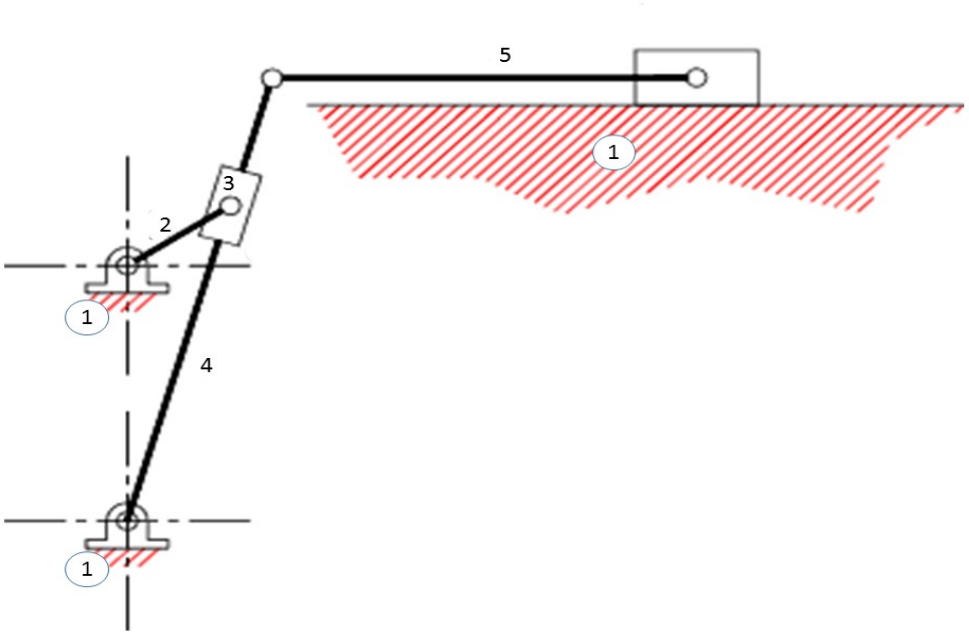
1b. If the input force F_{in} is 200lb, what force will the shock see?

PROBLEM 2: The mechanism below has an input link (link 2) length of 1.6 inches. The input angular velocity ω_2 is 20-1/s.

2a: Locate ALL instant centers associated with this mechanism.

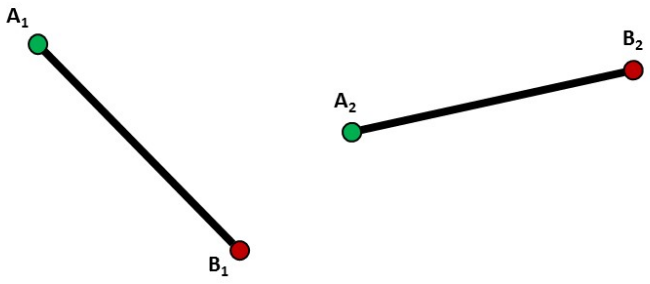
2b: Determine the Linear velocity of Link 6.

2c: Determine the Angular Velocity of Link 5.



PROBLEM 3: A device is being designed that needs to travel through the two positons shown.

3a: Can the mechanism be designed for rocker output if all the ground connections (roto-poles) must be below the two positons shown? Explain your answer in terms of a construction on the figure below.



3b: Use the figure above to design the rest of the mechanism that will move from position 1 above to position 2 and back in a single cycle. Design the drive dyad (NON-quick return) for the mechanism. The link that the drive dyad attaches to must rotate through 40° in traveling from positon 1 to position 2. The complete drive mechanism must be to the left of the mechanism and completely on the page.

PROBLEM 4: The drive link of the mechanism below is rotating with an angular velocity of 5-1/s and an angular acceleration of -20-1/s^2 when the drive link makes a 70° angle with the horizontal. Input the appropriate parameters into the program that you wrote for this class to determine all the angular and linear positions, velocities, and accelerations for this mechanics including point P. (PRINT OUT THE RESULTS OF YOUR PROGRAM AND STAPLE IT AFTER THIS PAGE)