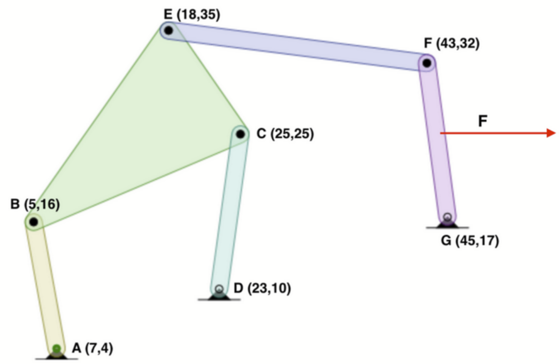
Here are a few pointers for Homework 1.

- Videos and other refresher material related to Homework 1 are available on Canvas and the links will be shared on Slack too.
- Feel free to use the “Homework” channel, your private “help_report_name” channel or your homework team’s channel to ask questions to the teaching team.
- Make sure to draw the coordinate axis without fail. One axis definition is sufficient for the linkage and the free body diagrams.
- References use either ASME or IEEE Format. You can use tools like Zotero, Mendeley or EndNote for this purpose. These tools are available as add-ons to Microsoft Word and various internet browsers.
- Include clear figures. Please use a software to sketch all figures. It is preferred that you tabulate the results (equations can be handwritten). Please type all equations and work and avoid handwritten content.
- Make sure to include a kinematic outline of the linkage. The kinematic outline should include the joint coordinates as well as the coordinates of the point where the applied load is acting.
- When you are writing the static and dynamic equations, you can express them in vector notation and expand the vectors. But you don't have to show substitution with numerical values.
- Regarding the Matlab script that you will be submitting: When I am executing the script during grading, the script should output the statics and dynamics forces and torques that you have discussed in the homework. All calculations must be done using Matlab.
- You can work in groups and share resources.
- The submissions have to be done through the individual channel. You will be sharing a link to your document (Google Doc or Word Online-Office 365 or Google Drive Link). Please do not share or upload PDFs. PDFs will not be accepted. The Google Doc or the Word Online (Office 365) should allow commenting.
- While doing the velocity, acceleration calculations- writing the appropriate loop equations and expanding them in symbolic (vector i and j) form is sufficient. A refresher picture for computing velocity and acceleration is shown below:



To Find angular velocity and angular acceleration of links:

Assume that you know the input angular velocity and acceleration of link AB.

We can write:

$$\overrightarrow{V_{C/D}} = \overrightarrow{V_B} + \overrightarrow{V_{C/B}}$$

$$\overrightarrow{A_{C/D}} = \overrightarrow{A_B} + \overrightarrow{A_{C/B}}$$

The above two equations will help calculate the angular velocities and angular accelerations of links BEC and CD.

Then, the equations below will help calculate the angular velocities and angular accelerations of links FE and FG

$$\overrightarrow{V_{F/G}} = \overrightarrow{V_{C/D}} + \overrightarrow{V_{E/C}} + \overrightarrow{V_{F/E}}$$

$$\overrightarrow{A_{F/G}} = \overrightarrow{A_{C/D}} + \overrightarrow{A_{E/C}} + \overrightarrow{A_{F/E}}$$

Once the angular velocities and angular accelerations have been determined, linear accelerations of the centers of masses of various links Can be determined

- $\overrightarrow{V_{C/D}} = \overrightarrow{\omega_{CD}} \times \overrightarrow{DC}$;
  $\overrightarrow{V_B} = \overrightarrow{\omega_{AB}} \times \overrightarrow{AB}$;$\overrightarrow{V_{C/B}} = \overrightarrow{\omega_{BEC}} \times \overrightarrow{BC}$

  Here ω_{CD} and ω_{BEC} are unknowns and you should be able to solve for those using the above vector expression.

  Similarly, the second set of equations can be written and ω_{EF} and ω_{FG} can be determined.
- Make sure to comment on your Matlab script so that it is easier to follow.
- Do not forget to include assumptions related to the applied load, material of the links and joints, the scaling you are doing to mimic real conditions. Some of these assumptions also require you to justify why those assumptions are valid.
- Note: You can also use the instant center method, in the place of the above vector-loop equations, for solving the angular velocities. I have uploaded a few videos on canvas related to using instant centers to compute angular velocities.
- Position Analysis requires use of Circle Intersection but using equations so that it can be solved using Matlab.
- Include assumptions used for computing mass and mass moment of inertia.
- Use units without fail at all locations.
- You do not have to consider the joint weights but state that as an assumption that you are ignoring those weights.
- You also have to state that the cross-section is uniform, material is homogenous, etc.
- If you are using SolidWorks or other CAD programs to extract mass and mass moment of inertia, you need not show additional calculations. Just indicate the assumptions and state that you used the program to extract these values.

- If you are using SolidWorks or other CAD Programs to sketch and model linkages, please share a link to those links along with your homework submission.
- In terms of presenting the result, show the values for the first position in a table and then a plot (or a graph) that showcases the variation of each quantity for all positions.
- For the purposes of Homework 1, feel free to assume constant input angular velocity, which means the input angular acceleration is zero. Note that the input angular velocity needs to be determined based on the number of parts/hr requirement.
- Here is a refresher on the circle intersection method:
  https://1drv.ms/v/s!AtHIJxxntmsWwncofwtCQBjbdX2d?e=vm1OYj |
  https://1drv.ms/v/s!AtHIJxxntmsWwnh5A3_o9_Oi2IQk?e=RLfYu7 |

Any questions, feel free to ask me after the lecture between 5-6pm. You can also post your questions as follow up discussions in Slack in the homework channel or in your help_report channel. Please do not hesitate to ask questions on any aspect of this homework. All questions are valid questions.