High-school co-op request: Development of experiential learning platforms for engineering courses and research tools.

Supervisor: Mike Welland, PhD, PEng, Associate Professor in Engineering Physics

Suggested requirements: Python, Github, scientific communication, (web design a bonus)

A student is requested to help develop the interactive, online components of a Numerical Methods course. The components would be incorporated into the open resources for EngPhys 3NM4: Numerical Methods for Engineers, and made available as independent OER for the larger community since numerical methods are pervasive across scientific disciplines.

Project description:

Numerical methods are the underpinning of a variety of engineering and science disciplines and their importance is ever increasing with adoption of computational tools. In truth they are beautiful, often simple and intuitive concepts, but this vision is obscured by the complicated mathematical machinery in which they are described.

The course EngPhys 3NM4: Numerical Methods for Engineering, was recently redesigned with the introduction of a new professor. The coarse notes are written in an interative Jupyter notebook hosted on GitHub pages (https://mwelland.github.io/ENGPHYS_3NM4) which provides a 'live' environment: students read the notes, see the code, and are able to examine, modify, and **run the code in place** on freely hosted servers. The students reported enjoying this format greatly as it offered an experiential learning environment, giving them the freedom to assimilate the information in their own way, while seeing the results firsthand without being inundated in mathematics. Meanwhile this format is open, accessible and equitable as computer requirements are minimal.

This format is also amenable to ground-breaking AI tools that allow for bespoke learning, e.g.: the 'NotepadLM 'Audio overview' (example on the main page). Exploration of possible tools for use in this context would be desirable.

The applicant will be requested to help improve the state of the online textbook, ensuring correct formatting, clear communication and navigation, and presentation. Further, they will generate examples of code and interactive visualizations using such tools as Plotly, hosted on the github.io platform (or Google Colab). The professor will guide and clarify the concepts and advise on informative plots, however the student is expected to innovate and pursue options independently under supervision.

Application information:

- The student should be a motivated, independent learner
- The student co-op application should include a cover letter (explaining why the applicant wants to do a co-op in Engineering Physics with Dr. Welland, a resume, and an academic transcript.
- The applicant should show proficiency in programming and scientific communication with an overall average of at least 80%.

- This position may be conducted remotely or in-person, with in-person attendance at McMaster campus requested periodically.

The department will review the applications and schedule an interview if the student is being considered for the position.