

## MME 2221b – Computational Methods for Mechanical Engineers

### COURSE OUTLINE – 2022-2023

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| <b>CALENDAR DESCRIPTION:</b> | The objective of this course is to introduce data organization and processing techniques using spreadsheet tools; and numerical methods, model formulation and programming using advanced mathematical software tools. Applications in applied mathematics and mechanical engineering will be considered throughout the course.  |
| <b>COURSE INFORMATION:</b>   | <p>Instructor: G. Daniel G. Langohr, PhD, PEng<br/>Room: SEB 2063A<br/>Tel: 519-661-2111 x 84859<br/>Email: <a href="mailto:glangohr@uwo.ca">glangohr@uwo.ca</a></p> <p>Lectures: M 9:30a – 10:30a (SEB 1059)<br/>W 12:30p - 1:30p (HSB 240)<br/>Th 9:30a - 10:30a (HSB 236)</p> <p>Tutorials: Fr 2:30p - 4:30p (ACEB 1400 &amp; ACEB 2435/2440)</p>   |
| <b>PREREQUISITES:</b>        | ES 1036A/B, NMM 1411A/B or the former Applied Mathematics 1411A/B, NMM 1414A/B or the former Applied Mathematics 1414A/B   |
| <b>COREQUISITES:</b>         | NMM 2270A/B or NMM 2276A/B   |
| <b>ANTIREQUISITES:</b>       | CEE 2219A/B, CBE 2291A/B   |
| <b>ACCREDITATION UNITS:</b>  | Engineering Science = 40%, Math = 40%, Engineering Design = 20%  |
| <b>LEARNING OUTCOMES:</b>    | Upon successful completion of this course, students will develop an advanced working knowledge of Microsoft Excel to organize, perform basic data analysis, and present data, as well as the ability to model and solve a variety of engineering problems using appropriate computational methods in MATLAB.   |
| <b>TOPICS:</b>               | <p><u>Spreadsheet topics include:</u></p> <ul style="list-style-type: none"><li>• data sorting &amp; plotting</li><li>• advanced formulae &amp; conditional formatting</li><li>• statistical analysis</li></ul> <p><u>Mathematical software topics include:</u></p> <ul style="list-style-type: none"><li>• numerical techniques for differentiation and integration</li><li>• the assessment of numerical error</li><li>• the solution of numerical roots problems</li><li>• linear and nonlinear algebraic equations</li><li>• curve fitting and the solution of ordinary differential equations</li></ul> |
| <b>CONTACT HOURS:</b>        | 3 lecture, 2 tutorial hours per week, half course  |
| <b>TEXTS:</b>                | <p>Chapra, Steven C, 2022, Applied Numerical Methods with Matlab® for Engineers and Scientists, 5th Edition (Recommended)</p> <p>Nordell, Randy, 2019, Microsoft Excel 365 Complete: In Practice, 2019 Edition (Optional)</p>  |
| <b>COMPUTING:</b>            | Students will be required to use Microsoft Excel and MATLAB to complete exercises and assignments. These programs are available in the Engineering computer labs, but students are also encouraged to load these programs on their personal computers.   |

**EXAMINATIONS  
AND QUIZZES:**

Evaluation will consist of eight in-tutorial assignments, two 2-hour quizzes administered in the tutorial sessions, and one 3-hour final exam. In-tutorial assignments are open book and performed in-class in groups. The quizzes are individual and closed book. For the final exam, students will be provided with an information sheet by the instructor if required; no other aid is allowed. A standard scientific calculator is permitted.

**UNITS:**

SI units will be used

**EVALUATION:**

The final grade is computed as follows (Tentative Schedule):

**Weekly In-Tutorial Assignments (8)****20%**

Assignment 1: January 20 (2.5%)

Assignment 2: January 27 (2.5%)

Assignment 3: February 3 (2.5%)

Assignment 4: February 17 (2.5%)

Assignment 5: March 3 (2.5%)

Assignment 6: March 10 (2.5%)

Assignment 7: March 24 (2.5%)

Assignment 8: March 31 (2.5%)

**Quizzes (2)****40%**

Quiz 1: February 10 (20%)

Quiz 2: March 17 (20%)

**Final Examination****40%**

The final exam will be scheduled during the final exam period

If a minimum mark of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

**COURSE  
POLICIES:****Tutorial Exercises:**

- Tutorial exercises will be carried out in the tutorial rooms where students will collect in their pre-determined groups.
- The tutorial exercises will consist of problems to be solved in a group format.
- Teams will receive problem solving assistance from TA and instructor who will be in the tutorial/zoom room. However, prior knowledge on problems assigned (like the ones solved by the instructor in the preceding week) will be highly beneficial.
- Tutorial exercises will be open book.
- Communication is encouraged during the tutorial exercises, but blatant copying of another team's work will be penalized.
- No make-up tutorial exercises will be offered regardless of reason missed.
- Missing a tutorial exercise with academic consideration will shift the weight of the missed exercise equally to the other tutorial exercises.
- Missing a tutorial exercise without academic consideration will result in a mark of zero for that exercise.
- Academic consideration for tutorial exercises (under 5% individual weight) can be obtained from the MME Undergraduate Coordinator or the Instructor.
- Tutorial Exercises are due at the end of the tutorial session in which they are assigned. No late submissions will be accepted.
- The default assumption is that everyone contributes equally to the in-tutorial assignment team effort and hence everyone should receive the same mark for the common team submission.
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Quizzes:

- Quizzes will be carried out in the tutorial rooms and will consist of problems to be solved individually in a closed book format.
- Communication is not permitted.
- No make-up quizzes will be offered regardless of reason missed.
- Missing a quiz with academic consideration will shift the weight of the missed quiz to the final exam.
- Missing a quiz without academic consideration will result in a mark of zero.
- Quizzes are due at the end of the tutorial session in which they are assigned. No late submissions will be accepted.
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Term Work:

- If a minimum of 50% is not obtained on term work, the student will fail the course irrespective of the mark obtained in the final examination.

Final Examination:

- The exam will take place during the April examination period.
- The exam will be closed book.
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.
- If technical issues will prevent a student from successfully completing and submitting the final exam, the official guidelines from Associate Dean's Office, Undergraduate Affairs will be followed. Options to be considered will include but without being limited to oral examination or make-up examination in the special examination period.
- If cheating during the final examination is suspected, the student will be required to participate in a one-on-one oral examination with the instructor. The mark obtained in the oral examination will supersede the one obtained during the written exam. If the student refuses his/her participation in the oral examination, the final exam will be automatically graded with zero and further academic penalties for scholastic offences will be applied.
- Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

Computer Requirements:

- It is highly recommended that all students install Microsoft Excel and MATLAB on their personal computers, and that they bring their laptops to the in-person tutorial sessions. This software is all available at no cost as part of the UWO software site license. If a student does not have a working laptop, one of the tutorial rooms has computers in it, and they can attend that room.

Course Content

- Lecture notes and online lecture videos are copyrighted to the instructor and hence they are legally protected.
- As such, the unauthorized posting and sharing of the copyrighted course content could be subjected to legal actions.

**ASSIGNMENTS:**

Homework may be assigned, and solutions will be provided. These will not be graded but will prepare the students for the graded tutorial exercises.

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- ENGLISH:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for improper use of English. Additionally, poorly written work, with the exception of final examinations, may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.
- ATTENDANCE:** Any student, who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.
- SSD:** *Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.*
- CHEATING:** University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.
- NOTE:** The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (ie.<50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.