SM-2302: Software for Mathematicians

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Semester I - 2025/26
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Module Description

Welcome to SM-2302! In many areas of mathematics, solutions to problems cannot be calculated explicitly and require the aid of computers. This module teaches students the programming skills required to solve such problems, namely in the area of differential equations, statistics, operational research, and other such areas of applied mathematics. Lectures will focus on teaching programming skills that are efficient and numerically stable, as well as how best to visualize problems. Students will appreciate the skills learned in this module when it comes to doing mathematical research during their final year projects and beyond.

Module Contents

- Learning `MATLAB` and `Python` languages for mathematical applications.
- `MATLAB` specific topics:
  - Introduction to MATLAB
  - Visualization & Programming
  - Solving Equations, Curve Fitting & Numerical Techniques
  - Advanced Methods
- `Python` specific topics:
  - Introduction to programming in Python
  - Solving Equations in Python
  - Visualization with `matplotlib`
  - Intro to Data Science and AI (Machine-Learning) in Python
- Preparation of report-style documents using LaTeX.
- Version control and social coding using Git and GitHub.

Reading

MATLAB

- Moler, Cleve. (2004). *Numerical Computing with MATLAB.* Society for Industrial and Applied Mathematics
- Stormy Attaway. (2013). *Matlab: A Practical Introduction to Programming and Problem Solving (3rd. ed.)*. Butterworth-Heinemann, USA

Python

- Müller, A.C. and Guido, S., 2016. *Introduction to machine learning with Python: a guide for data scientists.* "O'Reilly Media, Inc.".
- Üçoluk, G. and Kalkan, S., 2012. *Introduction to programming concepts with case studies in Python.* Springer Science & Business Media.

Git and GitHub

- Tobias Günther. *Learn Version Control With Git: A Step-by-step Course for the Complete Beginner.* CreateSpace Independent Publishing Platform, 2017. isbn: 9781548942465
- Ferdinando Santacroce. *Git Essentials: Create, merge, and distribute code with Git, the most powerful and flexible versioning system available.* Packt Publishing Ltd, 2017

LaTeX

- Stefan Kottwitz. *LaTeX Beginner's Guide: Create visually appealing texts, articles, and books for business and science using LaTeX.* Packt Publishing Ltd, 2021
- https://en.wikibooks.org/wiki/LaTeX

Class Format

See the end of the document for the full schedule.

There are two timetabled slots that are for this module:

1. Tuesday 2.10pm – 4.00pm
2. Friday 2.10pm – 4.00pm

Unless otherwise specified, classes will be in-person at **UTH, ICTC Lab 7**. The Tuesday sessions will normally be reserved for lectures, while Friday sessions are lab-based tutorials. You are expected to attend both classes every week.

Assessment

Take note that this module is wholly (100%) by coursework.

Formative assessment

- Lab-based tutorials

Summative assessment

- **20% online quizzes**: Four topical quizzes, 10% on `MATLAB` topics and 10% on `Python` topics.
- **20% class tests**: Two in-class assignment in the form of programming and/or debugging exercises.
- **60% group assignments**: This will be broken down into specific tasks
  - **10%** Individual contributions
  - **10%** Leadership role
  - **40%** Group report prepared in LaTeX

Semester Schedule

This schedule is tentative and subject to changes.

Week	Dates	Topic	Tuesday	Friday	Instructor	Assessment
W01	04/08 – 10/08	Introduction & Getting Started	Lecture	Setup	HR	
W02	11/08 – 17/08	[MATLAB] Intro to MATLAB	Lecture	Tutorial	HR	
W03	18/08 – 24/08	[MATLAB] Visualization & Programming	Lecture	Tutorial	HR	Quiz 1 (5%)
W04	25/08 – 31/08	[MATLAB] Solving Equations, Curve fitting & Numerical techniques	Lecture	Tutorial	HR	
W05	01/09 – 07/09	[Git] Git and GitHub	Lecture	PH[1]	NS	
W06	08/09 – 14/09	[MATLAB] Advanced Methods	Lecture	Tutorial	HR	Quiz 2 (5%)
W07	15/09 – 21/09	[MATLAB] Class test	Test	Group	HR	Test 1 (10%)
	22/09 – 28/09	*Mid-semester Break*				
W08	29/09 – 05/10	[Python] Intro to programming in Python	Lecture	Tutorial	NS	
W09	06/10 – 12/10	[Python] Solving Equations	Lecture	Tutorial	NS	
W10	13/10 – 19/10	[Python] Visualization with `matplotlib`	Lecture	Tutorial	NS	Quiz 3 (5%)
W11	20/10 – 26/10	[Python] Intro to Data Science and AI (Machine-Learning)	Lecture	Tutorial	NS	
W12	27/10 – 02/11	[LaTeX] Typesetting reports	Class 1	Class 2	HR	Quiz 4 (5%)
W13	03/11 – 09/11	[Python] Class test	Test	Group	NS	Test 2 (10%)
W14	10/11 – 16/11	Group assignment	Group	Group	HR/NS	
	17/11 – 24/11	*Revision Week*				
	24/11 – 30/11	*Exam Week*				Group Report (60%)

[1]Public holiday: Maulud Nabi 5/9/25