

Programa del curso

Semester 2018-10

Course: Scientific Programming (IBIO-2240)

Credits: 3

Professor: Pablo Arbeláez (pa.arbelaez@uniandes.edu.co)

Syllabus: [[PDF](#)]

Description

Computers are indispensable tools to solve engineering problems. Sometimes we want to use software specially developed to solve engineering problems, but sometimes we want to program our own idea to solve a scientific problem. Scientific programming requires different background knowledge from conventional mathematical equations, and it requires a good understanding of computer systems and numerical methods to maximize the advantages of computers. Hence, in this course we will learn the basics of such scientific programming with examples from biomedical engineering.

This course is divided into exactly two portions: the first half of the course is devoted to practicing high-level programming using MATLAB and the second half is devoted to scientific computation utilizing MATLAB.

Objective

This course aims at training students in high-level programming, numerical methods, and their application to solve engineering problems.

After completing the course, the student should be able to:

- Use high-level coding skills with MATLAB to develop computer programs
- Understand numerical methods to solve scientific problems
- Design algorithms based on numerical methods to solve engineering problems

Methodology

For the course development, the following activities will take place:

- **Lectures** are an essential part of this course, they present the topics for classes and are expected to be open and interactive discussions on the topics covered in the course.
- **Laboratories and homework** are also a fundamental part of the course as they complement and enhance the topics covered in the theory class with hands-on

implementation.

- **A Final Project**, in which students will develop their ability to work in groups and apply the contents of the course in a larger final project, which will address a real-world engineering problem.

Contents

PART I Programming with MATLAB

1. Basic programming in MATLAB
2. M-Files, Functions
3. Graphics
4. Symbolic Mathematics

PART II Numerical Methods using MATLAB

1. Nonlinear Equations
2. Approximation
3. Numerical differentiation & Integration
4. Linear systems
5. Ordinary differential equations

Activity	Final grade %
4 Partial Exams	60
Laboratories and homework	25
Final Project	15

Textbook

PART I Programming with MATLAB - Higham DJ, Higham NJ, MATLAB Guide, SIAM, 2005. -

http://www.mathworks.com/academia/student_center/tutorials/launchpad.html **PART II**

Numerical Methods using MATLAB - Quarteroni A, Saleri F, Gervasio P.

Scientific Computing with MATLAB and Octave, 3rd Ed. Springer, 2010. - King

MR, Mody NA. Numerical and Statistical Methods for Bioengineering: Applications in

MATLAB (Cambridge Texts in Biomedical Engineering). Cambridge University Press,

2010. - Dunn S, Constantinides A, Moghe PV. Numerical Methods in Biomedical

Engineering. Elsevier Academic Press, 2006. - Press WH, Flannery BP, Teukolsky SA,

Vetterling WT. Numerical Recipes in C: The Art of Scientific Computing. Cambridge

University Press, 2nd edition, 1992.

Calendar

M D	TOPICS	LAB
1 24 I	01. Introduction	Q01
26 V	02. Basics (H2, H3)	

M	D	TOPICS	LAB
	31 I	03. Arithmetic (H4)	L01
2	2 V	04. Matrices (H5, H15)	
	7 I	05. Data types (H18)	Review
	9 V	Review	
	14 I	Partial Exam 1	L02
	16 V	06. Flow control 1 (H6, H13)	
	21 I	07. Flow control 2 (H6, H13)	L03
	23 V	Application	
	28 I	08. I/O (H13)	L04
3	2 V	09. M-files (H7)	
	7 I	10. Functions (H10, H16, H20)	Review
	9 V	Review	
	1 I	Partial Exam 2	L05
	4 V	11. Graphics (H8) - 30% final grade	
	16 I	12. What can't be ignored (Q1)	L06
	21 V	13. Nonlinear Equations 1 (Q2)	
	23 I	Easter	
	28 V	Easter	
	30 I	14. Nonlinear Equations 2 (Q2)	L07
4	4 V	15. Approximation (Q3)	
	6 I	16. Approximation (Q3)	Review
	11 V	Review	
	13 I	Partial Exam 3	L08
	18 V	17. Numerical Differentiation and Integration (Q4)	
	20 I	18. Numerical Differentiation and Integration (Q4)	L09
	25 V	19. Linear Systems (Q5)	
	27 I	20. Ordinary Differential Equations (Q7)	L10
5	2 V	21. Ordinary Differential Equations (Q7)	
	4 V	Review	Review
	9 I	Partial Exam 4	
	11 V	Final project due	

Note: Symbols in parentheses indicate the chapter from the main textbooks: Higham (H) or Quarteroni (Q)

Reglamento

- Los estudiantes deben preparar con anticipación los temas correspondientes a cada clase.
- Las notas finales del curso se aproximarán: mayor o igual a 0.25 y 0.75 hacia arriba y menor a 0.25 y 0.75 hacia abajo.

- Para aprobar la materia es indispensable sacar mínimo 3.0 sin aproximaciones
- El profesor tiene un plazo de 10 días hábiles luego de una evaluación para publicar la nota. Los alumnos tienen un plazo de 8 días hábiles luego de publicada una nota para llevar a cabo reclamos; luego de este plazo no se admitirá ningún reclamo y la nota se considerará definitiva.
- **Los intentos de fraude serán manejados según el reglamento de la universidad**
- Todos los trabajos y tareas deberán realizarse de manera individual a menos que se indique lo contrario.
- Las excusas médicas se manejarán de acuerdo con el reglamento de la universidad
- El uso de teléfonos celulares, tabletas y demás dispositivos electrónicos ajenos al curso está estrictamente prohibido durante las clases. Dichos dispositivos deben permanecer apagados y guardados en la maleta durante las clases.
- Con cinco fallas injustificadas se pierde la materia. Se considera causal de falla: La no asistencia a la clase, el uso de redes sociales, teléfonos celulares, reproductores y aparatos electrónicos que no se requieran en clase; llegar 15 minutos después de la hora de inicio de la clase; no haber preparado o traído el material necesario para cada clase.
- Es importante la buena escritura con normas mínimas de gramática y ortografía. Se penalizará con rebajas en la nota los trabajos con mala ortografía, mal redactados o que no cumplan los requisitos de formato.
- Para la elaboración de los proyectos y especialmente para la citación de fuentes se recomienda consultar el texto [Cartilla de Citas: Pautas para citar textos y hacer listas de referencias] según las normas de la Asociación Americana de Psicología - APA-elaborado por la Decanatura de Estudiantes, o libros de consulta y páginas de Internet que traten el tema.