PREREQUISITES FOR THE AGRICULTURAL ENGINEERING MSc. PROGRAMME

Before attending classes in the Agricultural Engineering MSc. programme, it is advisable that the students have a satisfactory background in some study subjects (see syllabi and recommended textbooks).

In particular:
- <u>Students with an Engineering background</u>
    - Automatic control

- <u>Students with an Agrarian background</u>
    - Mathematics
    - Electrical engineering
    - Mechanical engineering

For all students who do not have a background in computer programming, it is advisable to read the following tutorial on Python focusing on chapters 1-6
do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf

Prerequisites

<u>Mathematics</u>
High school topics
1. Algebra of polynomials
2. Equations
3. Inequalities
4. Systems of first and second order
5. Trigonometry
6. Principles of Euclidean geometry (areas and volumes of elementary geometric figures)
7. Elements of analytic geometry
8. Exponentials and logarithms and their properties

Calculus
1. Numerical sets
2. Differential and integral calculus in one variable
3. Basic notions of linear algebra and geometry in vector spaces

Automatic control
1. System modeling (modelling concepts, state space models, examples): Åström & Murray, Chapters 2, 3
2. Dynamic behavior (differential equations, qualitative analysis, stability): Åström & Murray, Chapter 5 (5.1-5.3)
3. Linear systems (matrix exponential, input/output response, linearization): Åström & Murray, Chapter 6
4. Transfer functions (frequency domain modelling, transfer function, block diagrams, Bode plots, Laplace transform): Åström & Murray, Chapter 9
5. Frequency domain analysis (loop transfer function, Nyquist criterion, stability margins, Bode's relations, generalized gain and phase): Åström & Murray, Chapter 10 (10.1, 10.2, 10.3)
6. PID control: Åström & Murray, Chapter 11
7. Frequency domain design: Åström & Murray, Chapter 12
8. Basics of discrete time systems and digital control: Franklin, Powell & Workman, Chapters 3-7

Electrical engineering
1. Basic concepts of electricity
2. Ohm's law and Kirchhoff's laws
3. Series and parallel circuits
4. DC network analysis
5. Capacitors and inductors
6. Capacitor, inductor and resistor circuits

Mechanical engineering
1. Kinematics of a point in the plane
2. Kinematics of a rigid body in the plane
3. Newton's laws of dynamics
4. Coulomb friction law
5. Kinetic and potential energy (spring and gravitational potential), work and power for the point and the rigid body
6. Dissipated energy (friction and damping)

Textbooks

<u>Mathematics</u>
- James Steward
  Single Variable Calculus
  Cengage Learning
  ISBN: 9781305548725
- Robert A. Adams, Christopher Essex
  Calculus: a complete course
  Pearson, Toronto
  ISBN: 9780321781079
- James Steward
  Essential Calculus
  Cengage Learning
  ISBN: 9781133710875
- Seymour Lipschutz, Marc Lipson
  Schaum's Outline of Linear Algebra
  McGraw-Hill Education
  ISBN: 9781260011456

<u>Automatic control</u>
- K.J. Åström and R.M. Murray
  Feedback Systems: An Introduction for Scientists and Engineers
  available on the web:
  www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page
- G.F. Franklin, J.D. Powell, M.L. Workman
  Digital control of dynamic systems
  Addison Wesley, 1997
- G.F. Franklin, J.D. Powell, A.F. Emami-Naeini
  Feedback Control of Dynamic Systems
  Pearson, 2019

<u>Computer science</u>
- K.N. King
  C Programming A Modern Approach
  2nd Ed
  available on the web: archive.org/details/c-programming-a-modern-approach-2nd-ed-c-89-c-99-king-by
- An online C compiler
  www.onlinegdb.com/online_c_compiler

Electrical engineering
- C.K. Alexander, M.N.O. Sadiku
  Fundamentals of Electric Circuits
  McGraw-Hill

Mechanical engineering
- R.C. Hibbler
  Engineering Mechanics: Dynamics in SI Units
  Pearson, 2016
  ISBN: 978-1292088723
- F. Cheli, G. Diana
  Advanced dynamics of mechanical systems
  2020