



# HÖGSKOLAN I GÄVLE

## Multivariable and Nonlinear Control Systems 7.5 cr

*Flervariabel och olinjär reglerteknik 7,5 hp*

Set by Faculty of Engineering and Sustainable Development

**Version**

**Set at**

**Valid from**

5/27/19

**HT2019**

<b>Level</b>	A1N
<b>Education level</b>	Second cycle
<b>Course identifier</b>	EEA004
<b>Credits</b>	7.5 cr
<b>Main field of study</b>	Electronics
<b>Subject group</b>	Electrical Engineering
<b>Disciplinary domain</b>	Technology 100.0 %

**Learning outcomes** After completion of the course the student shall be able to

Knowledge and understanding

1. explain the use of observers in control system
2. describe optimal control

Skills and abilities

3. perform sensitivity and robustness analysis of control system
4. describe commonly used mathematical tools for modelling and stability analysis of nonlinear systems
5. design controllers for nonlinear systems
6. design controllers for multivariable systems

Values and attitudes

7. compare and evaluate different control strategies
8. describe results from scientific reports within the the area.

**Course content** Introduction to discrete-time controllers  
Observers

Sensitivity analysis  
 Multivariable control theory  
 Decoupling  
 Linear–Quadratic–Gaussian (LQG)  
 Robustness analysis  
 H-infinity control design  
 Modelling of nonlinear systems  
 Nonlinear systems - Stability analysis  
 Lyapunov functions  
 Circle criterion  
 Nonlinear systems – Control design  
 Optimal control

**Teaching** Lectures and exercises

**Prerequisites** English language proficiency equivalent to (the Swedish upper secondary school) English course 6/B.  
 Completed courses of 180 credits at undergraduate level including Control Engineering 7.5 credits or equivalent

**Examination** Written Examination and assignments  
  
 Module 0010 Written Examination 5 credits, examines learning outcomes 1, 2, 5, 6 and 8, grades A-F  
 Module 0020 Assignments 2.5 credits, examines learning outcomes 3-7, grades A-F

**Grade** A, B, C, D, E, Fx, F

**Other regulations** Degree Criteria for final grade will be given by course responsible or examiner latest at the beginning of the course.

**Sustainable environment** A minor part of the course content deals with sustainable development.

<b>Module</b>			
	0010	Written Examination	5 cr      Grade: AF
	0020	Assignments	2.5 cr      Grade: AF