

Course Syllabus:

Electronics MA, Signal Processing and Analysis, 7.5 credits

General data

Code	EL050A
Subject/Main field	Electronics
Cycle	Second cycle
Orientation (name)	
Credits	7.5
Progressive specialisation	A1N , Second cycle, has only first-cycle course/s as entry requirements
Answerable institution	Electronics Design
Adapted	2018-02-01
Established	2018-04-04
Date of change	2018-08-20
Valid from	2018-07-01

Aim

The purpose of this course is to give students understanding for the theory of digital filters and practical skills in implementation and analysis of digital filters using software tools. It also gives an insight in several areas of digital signal processing and analysis for one, two and three dimensions, including knowledge in modelling.

Course objectives

After completed course, the student should be able to:

- design and analyze FIR- and IIR filters using software tools for computation of filter parameters,
- apply and analyze principles for different realizations of time discrete digital filters and for 2D filtration of images in spatial domain,
- apply and analyze method for conversion of floating point to fixed point numbers in digital signal processing systems,
- apply and analyze method for modelling, simulation and exploration of quantization effects in fixed point computations,
- design and model operations for processing and analysis of images and video. Those operations are: preprocessing, frequency analysis, segmentation, morphology, labelling, feature extraction and classification of image objects,
- apply and analyze method for camera calibration,
- describe methods for 3D image capture using time of flight, laser triangulation and stereo cameras,
- design and model basic operations for processing of 3D point clouds. Those operations are: scaling, translation, rotation and projection.

Content

- Time- and amplitude discrete filters
- FIR filters
- IIR filters
- filter realizations
- stability for filters
- computer aided computation of filter parameters
- computer aided fixed point modelling and simulation of quantization effects in filters
- image analysis (pre-processing, frequency analysis, segmentation, morphology and object analysis)
- signal processing for 3D imaging using laser triangulation, stereo camera or Time-Of-Flight sensor
- camera calibration
- processing of 3D point clouds
- methods for classification
- signal processing in real-time

Entry requirements

Electrical Engineering BA (ABC), 60 credits, including courses in digital electronics and metrology. Computer Engineering BA (A), 12 credits, including course in imperative programming. Mathematics BA (A), 18 credits.

Selection rules and procedures

The selection process is in accordance with the Higher Education Ordinance and the local order of admission.

Teaching form

Teaching is provided in the form of lectures, exercises and laboratory experiments. Student must perform extensive self studies in addition to scheduled hours in class.

Examination form

I101: Written assignment , 0,0 hp

Grading: Fail (U) or Pass (G)

L101: Laborations including written report and oral presentation , 4,0 hp

Grading: Seven-grade scale, A, B, C, D, E, Fx and F. Fx and F represent fail levels.

T101: Written examination , 3,5 hp

Grading: Seven-grade scale, A, B, C, D, E, Fx and F. Fx and F represent fail levels.

0.0 hp, I101: Written assignment, signature on form for dividing students into lab groups

Grades: Pass or Fail.

4.0 hp, L101: Laborations including written report and oral presentation,

Grades: A, B, C, D, E, Fx and F. A-E are passed and Fx and F are failed.

3.5 hp, T101: Written examination

Grades: A, B, C, D, E, Fx and F. A-E are passed and Fx and F are failed.

Grading criteria for the subject can be found at www.miun.se/gradingcriteria.

The examiner has the right to offer alternative examination arrangements to students who have been granted the right to special support by Mid Sweden University's disabilities adviser.

Grading system

Seven-grade scale, A, B, C, D, E, Fx and F. Fx and F represent fail levels.

Other information

A student who did not pass I101 before third week of course will not be able to continue on the course.

This because the university will then register an "early interruption of studies"

Course reading

Required literature

Author: Carsten Steger, Markus Ulrich and Christian Wiedermann

Title: Machine Vision Algorithms and Applications

Publisher: Wiley-VCH

Comment: ISBN: 978-3-527-40734-7

Author: Kim Phil

Title: MATLAB Deep Learning : With Machine Learning, Neural Networks and Artificial Intelligence

Publisher: Springer

Comment: ISBN : 9781484228456

Author: L. Eriksson et al.

Title: Multi- and Megavariate Data Analysis – Part I Basic Principles and Applications

Edition: Second revised and enlarged edition

Publisher: Umetrics Academy

Comment: ISBN 91-973730-2-8