## TWO YEAR DOUBLE DEGREE MASTERS PROGRAM
### MS (SIGNAL PROCESSING)
#### FIRST YEAR I SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>Name of the Subject</th>
<th>Periods</th>
<th>Maximum Marks</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETC012</td>
<td>Signal Processing-II</td>
<td>30</td>
<td>50</td>
<td>100</td>
<td>7.5</td>
</tr>
<tr>
<td>MAB014</td>
<td>Complex Analysis and Transforms</td>
<td>30</td>
<td>50</td>
<td>100</td>
<td>7.5</td>
</tr>
<tr>
<td>MSA002</td>
<td>Random Processes and Time Series Analysis</td>
<td>30</td>
<td>50</td>
<td>100</td>
<td>7.5</td>
</tr>
<tr>
<td>ETXXX</td>
<td>Introduction to MATLAB (Theory cum Lab)</td>
<td>30</td>
<td>50</td>
<td>100</td>
<td>7.5</td>
</tr>
</tbody>
</table>

I Sem. TOTAL CREDITS: 30
## COURSE DESCRIPTOR

**Signal Processing II**  
**Signalbehandling II**  
*7.5 ECTS credit points (7,5 högskolepoäng)*

<table>
<thead>
<tr>
<th>Course code: ET1303</th>
<th>Version: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational level: Basic level</td>
<td>Applies from: 2007-03-07</td>
</tr>
<tr>
<td>Course level: C</td>
<td>Approved: 2007-03-07</td>
</tr>
<tr>
<td>Field of education: Technology</td>
<td>Replaces course descriptor approved: There is no previous course plan</td>
</tr>
<tr>
<td>Subject area: Electrical engineering</td>
<td></td>
</tr>
</tbody>
</table>

### 1 Course title and credit points

The course is titled Signal Processing II/Signalbehandling II and awards 7,5 credit points. One credit point (högskolepoäng) corresponds to one credit point in the European Credit Transfer System (ECTS).

### 2 Decision and approval

This course is established by The Board of the Department of Electrical Engineering 2007-03-07. The course descriptor is approved by The Board of the Department of Electrical Engineering and applies from 2007-03-07. The Department of Signal Processing is responsible for the realization of the course. Reg.no. TEK56-81/07.

### 3 Objectives

The course extends the basic course in signal processing through letting the students develop theoretical knowledge within modern digital signal processing and through letting the students acquire knowledge of and insight into applied signal processing problems.

### 4 Content

Central items of the course are:
- Sampling, reconstruction, decimation, interpolation and sample frequency conversion
- Digital filter structures: FIR- and IIR filters
- Design of FIR-filter
- Design of IIR-filter via analog filters
- Discrete Fourier transform (DFT)
- Z-transform
- Spectral estimation

### 5 Aims and learning outcomes

On completion of the course the student will:
- be able to understand and use the Z-transform
- be able to understand and use the Discrete Fourier Transform
- be able to design basic FIR/IIR filters and also
master various filter structures, as direct form 1, direct form 2 and Lattice
• be able to estimate effect spectra through classical methods; the periodogram, the Bartlett, Welch, and Blackman-Turkey’s methods
• be able to understand and apply sampling and reconstruction and also decimation and interpolation

6 Generic skills
The following generic skills are trained in the course:
• General knowledge within the subject area for the studies
• Skill in applying the knowledge in practice
• Solution of problems
• Skill in analysis and synthesis

7 Learning and teaching
The teaching comprises lectures, laboratory work and exercises. The instruction consists of lectures, laboratory work, and exercises. During the arithmetical exercises the exercise supervisor will illustrate how the studied theory should be applied on signal processing problems. In order to further explain the theory and its applications compulsory laboratory work assignments form part of the course. These laboratory work assignments can be done individually or in a group. The instruction is carried out entirely or partly in English.
The teaching language is partly, or fully, English.

8 Assessment and grading
Examination of the course

<table>
<thead>
<tr>
<th>Code</th>
<th>Module</th>
<th>Credit</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0720</td>
<td>Laboration 1</td>
<td>0.8hp</td>
<td>U/G</td>
</tr>
<tr>
<td>0730</td>
<td>Laboration 2</td>
<td>0.7hp</td>
<td>U/G</td>
</tr>
</tbody>
</table>

1 Determines the final grade for the course, which will only be issued when all components have been approved.
The course will be graded U, 3, 4 or 5. The examination will take place through a written examination and also through presentation of the compulsory laboratory work assignments. Grading of the laboratory work assignments is done with the grades Godkänd [Passed] or Underkänd [Failed]. For a final grade of the course the grade Godkänd [Passed] is required for the laboratory work part. On request grades according to ECTS will be given.

9 Course evaluation
The course coordinator is responsible for systematically gathering feedback from the students in course evaluations and making sure that the results of these feed back into the development of the course.

10 Prerequisites
For admission to the course the following courses is required:
11 Field of education and subject area
The course is part of the field of education Technology and is included in the subject area electrical engineering.

12 Restrictions regarding degree
The course cannot form part of a degree with another course, the content of which completely or partly corresponds with the contents of this course.

13 Course literature and other teaching material

COURSE DESCRIPTOR

Complex Analysis and Transforms
Komplex analys och transformer
7.5 ECTS credit points (7,5 högskolepoäng)

Course code: MA1305
Educational level: Basic level
Course level: C
Field of education: Natural sciences
Subject area: Mathematics/applied mathematics

1 Course title and credit points
The course is titled Complex Analysis and Transforms/Komplex analys och transformer and awards 7,5 credit points. One credit point (högskolepoäng) corresponds to one credit point in the European Credit Transfer System (ECTS).

2 Decision and approval
This course is established by The Board of the Department of Mathematics and Science 2007-02-13.
The course descriptor was revised by The Board of the Department of Mathematics and Science and applies from 2007-02-13.
Replaces course descriptor approved: 2006-06-13

3 Objectives
The course yields knowledge in analytic functions and residue calculus in order to teach the Fourier, Laplace and z-transforms. These constitute the background of applications to telecommunications, signal processes and other technical fields.
4 Content

• Complex functions, analytic functions, the Cauchy-Riemann equations, integration along open and close curves
• The Taylor and Laurent series, poles and residues, the Cauchy theorems
• Calculations of the values of real integrals over the intervals using residues
• The Laplace, Fourier and $z$-transforms
• Solution of ordinary differential equations, the Volterra integral equations and difference equations

5 Aims and learning outcomes

On completion of the course the student will be able to:

• Learn the basis of complex analysis and residue calculus
• Evaluate the values of generalized integrals of the Laplace and Fourier type by means of residue calculus
• Learn the Laplace, Fourier and $z$-transforms
• Use the transforms and the residue calculus to solutions of ordinary differential equations and difference equations
• Analyze and synthesize hypotheses to determine correct methods of solutions
• Express oneself in English when describing the problems that involve mathematical terms introduced during the course

6 Generic skills

The following generic skills are trained in the course:

• Skills in searching of the mathematical apparatus that has been learnt to select solution models fitted to the posed questions
• Skills in applying of the mathematical contents of the course to formulations of technical tasks in such subjects as telecommunications, signal processes, etc.
• Skills in accomplishing, in writing and orally, the solutions of formulated tasks concerning the domains mentioned above

• Skills in working in interdisciplinary teams
• Skills in expressing problems in English

7 Learning and teaching

The teaching comprises lectures and exercises. The teaching language is partly, or fully, English

8 Assessment and grading

Examination of the course

<table>
<thead>
<tr>
<th>Code</th>
<th>Module</th>
<th>Credit</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>0710</td>
<td>Written examination[1]</td>
<td>7.5hp</td>
<td>U/3/4/5</td>
</tr>
</tbody>
</table>
1 The final grade is the same as the examination mark.

The course will be graded U, 3, 4 or 5. On request grades according to ECTS will be given.

9 Course evaluation
The course coordinator is responsible for systematically gathering feedback from the students in course evaluations and making sure that the results of these feedback into the development of the course.

10 Prerequisites
15 credits in one-variable calculus and 7.5 credits in multi-variable calculus and theory of transforms (or the equivalent).

11 Field of education and subject area
The course is part of the field of education Natural sciences and is included in the subject area mathematics/applied mathematics.

12 Restrictions regarding degree
The course cannot form part of a degree with another course, the content of which completely or partly corresponds with the contents of this course.

13 Additional information
The course is included in programmes at Blekinge Institute of Technology and is also available as a separate course.

14 Course literature and other teaching material
Random Processes and Time
Series Analysis,
Basic (7.5 ECTS)
Course code: MSA002

1 Scope and name of course
The course is titled Random Processes and Time Series Analysis/Stokastiska processer och tidsserier and awards 5 Swedish points.

2 Decision regarding approval of syllabus
This syllabus is approved by Dep of Health, Science and Mathematics aug 23, 2002. The syllabus was revised by The Board of the Department of Mathematics and Science and applies from okt 17, 2006.

3 Objective and purpose
The aim of the course is to provide for understanding random processes with technical applications.

4 Content
Random processes are treated mainly from a probabilistic viewpoint both in the time and frequency domains. Applications in signal processing and telecommunications are emphasized.
- Repetition of common distributions for one-dimensional random processes
- Multi-dimensional distributions
- Orientation about simulation of random variables
- Chi-square test of assumptions about distribution
- Random processes analysed in the time domain: Continuous and discrete time, stationarity, auto-correlation and autocovariance functions, continuity and differentiability, integration
- Special cases: the Poisson process, the Gaussian process
- Random processes analysed in the frequency domain: spectral density, the Fourier transform, cross spectral density
- Linear systems with random input: the impulse spectral density
response, the transfer function, spectral densities for input and output

• Markov chains
• Markov processes
• Elementary queuing theory: M/M/m, M/G/1.

5 Teaching
The tuition consists of lectures and seminars. Tutorials can also be a part of the tuition. The teaching language is partly, or fully, English.

6 Examination, forms of assessment and grading system
Examination of the course

<table>
<thead>
<tr>
<th>Code Title Scope(ECTS) Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written examination 5p (7.5) F/P/3/4/5</td>
</tr>
</tbody>
</table>

The course will be graded Fail, Pass, 3, 4 or 5. The course ends with a written exam. Preliminary exams can be a part of the examination.

7 Entrance qualifications
The student must have passed courses in mathematics corresponding to 15 credits including linear algebra, elementary one- and multidimensional calculus, Fourier series and the Fourier and Laplace transforms and courses of mathematical statistics corresponding to 5 credits (or the equivalent).

8 Area of education and subject field
The course is part of the area of education Natural sciences and is included in the subject mathematical statistics.

9 Restrictions regarding degree
The course cannot form part of a degree with another course, the content of which completely or partly corresponds with the contents of this course.

10 Additional information
The course is included in programmes at Blekinge Institute of Technology and is also available as a separate course.
The level: A (1-20 p) in the subject Mathematical statistics.
General course classification: Science.

11 Course evaluation
The course manager is responsible for the views of students on the course being systematically and regularly gathered and that the results of the evaluations in various forms affect the form and development of the course.
12 Course literature and other teaching material
Supplementary material provided by the department.

COURSE DESCRIPTOR

INTRODUCTION TO MATLAB
(LABORATORY COURSE)
7.5 credits

1 Design of IIR filter
2 Design of FIR filter
3 DFT (Discrete Fourier Transform)
4 Spectral Estimation
5 Simulation of Random Variables
6 Simulation of multiple Random Variables