COURSE SYLLABUS AND COURSE REQUIREMENTS
2022/2023 SEMESTER I.

Course title	*System Theory*
Course Code	IVB352ANMI
Hours/Week: le/pr/lab	2/2/0
Credits	5
Degree Programme	Computer Science Eng. (BSc)
Study Mode	full-time
Requirements	exam
Teaching Period	fall
Prerequisites	Eng. Mathematics 2.
Department(s)	Dept. of Technical Informatics
Course Director	Dr. Sári Zoltán
Teaching Staff	Dr. Sári Zoltán

COURSE DESCRIPTION

A short description of the course (max. 10 sentences).
Neptun: Instruction/Subjects/Subject Details/Basic data/Subject description

Fundamentals of signals and systems, system modelling and representation. Description of linear systems in time, frequency and complex frequency domain. Mathematical description of signals, important signal categories, properties of signals. Properties of systems, linearity, time-invariance, stability etc. System analysis in the time domain, ODE representation if LTI systems, response functions, convolution, state-space representation. System analysis in frequency domain, Fourier-series, Fourier-transform, spectral representation of signals and systems. The complex frequency domain and its applications in system analysis, the Laplace-transform. Sampling and reconstruction, the Shannon-theorem and its interpretation. Representation and analysis of discrete-time signals and systems, discrete-time Fourier-transform, z-transform. FIR and IIR systems, fundamentals of digital filtering.

SYLLABUS

Neptun: Instruction/Subjects/Subject Details/Syllabus

1. GOALS AND OBJECTIVES

Goals, student learning outcome.
Neptun: Instruction/Subjects/Subject Details/Syllabus/Goal of Instruction

The course provides an insight into the fundamental concepts and techniques of signal processing, and the representation of linear systems in time-, frequency-, and complex frequency-domain. The main goal of the course is to equip the students with the basic tools required for the analysis of the input-output relation of continuous- and discrete-time systems based on the description of the characteristics and connections of the components and parts, applying the corresponding mathematical apparatus.
The course helps developing analytical thinking and problem solving, and provides solid foundations for fields involving image- and sound processing, communication networks, modelling and controlling of processes and systems.

2. COURSE CONTENT

Neptun: Instruction/Subjects/Subject Details/Syllabus/Subject content

	TOPICS
LECTURE	1. *Fundamentals, signals and their properties* 2. *Systems and their properties, application of response functions* 3. *ODE representation of LTI systems, state-space representation* 4. *Sinusoidal signals, the frequency response* 5. *Fourier-series, spectrum* 6. *Fourier-transform, bandwidth, shape-preserving transmission* 7. *Laplace-transform and its applications* 8. *Sampling and reconstruction*

	9. Time-domain analysis of discrete-time systems *10. The Discrete Fourier Transform, and the discrete-time Fourier-transform* *11. Z-transform and its applications*
PRACTICE	*1. Fundamentals, signals and their properties* *2. Systems and their properties, application of response functions* *3. ODE representation of LTI systems, state-space representation* *4. Sinusoidal signals, the frequency response* *5. Fourier-series, spectrum* *6. Fourier-transform, bandwidth, shape-preserving transmission* *7. Laplace-transform and its applications* *8. Sampling and reconstruction* *9. Time-domain analysis of discrete-time systems* *10. The Discrete Fourier Transform, and the discrete-time Fourier-transform* *11. Z-transform and its applications*

DETAILED SYLLABUS AND COURSE SCHEDULE

ACADEMIC HOLIDAYS INCLUDED

LECTURE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Mathematical foundations, representation and properties of signals			
2.	Concept, representation and properties of systems, signal flow networks, response functions and their applications, convolution and its applications, concept of stability			
3.	ODE representation of LTI systems, state-space representation, asymptotic stability			
4.	Complex representation of sinusoidal signals, sinusoidal response, the concept and representation of frequency response			
5.	Fourier-series, sinusoidal decomposition of continuous-time periodic signals, spectrum, periodic response			
6.	The Fourier-transform, spectral represen-tation of signals and systems, bandwidth, shape-preserving transmission			
7.	The Laplace-transform and its applications, the transfer function, operator domain solution of ODEs of LTI systems, the inverse Laplace-transform			
8.			Midterm test 1.	
9.	**Autumn brake**			
10.	Sampling and reconstruction, spectrum of sampled signal, Shannon sampling theorem			
11.	Time-domain analysis of discrete-time systems, response functions, convolution, FIR and IIR systems, stability			
12.	DT sinusoidal signal and its properties, frequency response, DFT, DTFT			
13.	The z-transform and its applicatons, transfer function, the inverse z-transform			
14.			Midterm test 2.	
15.	**Retakes**			

PRACTICE, LABORATORY PRACTICE

week	**Topic**	**Compulsory reading; page number (from … to …)**	**Required tasks (assignments, tests, etc.)**	**Completion date, due date**
1.	Mathematical foundations, representation and properties of signals			
2.	Concept, representation and properties of systems, signal flow networks, response functions and their applications, convolution and its applications, concept of stability			
3.	ODE representation of LTI systems, state-space representation, asymptotic stability			
4.	Complex representation of sinusoidal signals, sinusoidal response, the concept and representation of frequency response			
5.	Fourier-series, sinusoidal decomposition of continuous-time periodic signals, spectrum, periodic response			
6.	The Fourier-transform, spectral representation of signals and systems, bandwidth, shape-preserving transmission			
7.	The Laplace-transform and its applications, the transfer function, operator domain solution of ODEs of LTI systems, the inverse Laplace-transform			
8.	**Exercises, Consultation**			
9.	**Autumn brake**			
10.	Sampling and reconstruction, spectrum of sampled signal, Shannon sampling theorem			
11.	Time-domain analysis of discrete-time systems, response functions, convolution, FIR and IIR systems, stability			
12.	DT sinusoidal signal and its properties, frequency response, DFT, DTFT			
13.	The z-transform and its applicatons, transfer function, the inverse z-transform			
14.	**Exercises, Consultation**			
15.	**Exercises, Consultation**			

3. ASSESSMENT AND EVALUATION

(Neptun: Instruction/Subjects/Subject Details/Syllabus/Examination and Evaluation System)

ATTENDANCE

In accordance with the Code of Studies and Examinations of the University of Pécs, Article 45 (2) and Annex 9. (Article 3) a student may be refused a grade or qualification in the given full-time course if the number of class absences exceeds 30% of the contact hours stipulated in the course description.

Method for monitoring attendance *(e.g.: attendance sheet / online test/ register, etc.)*

Attendance sheet on practice sessions. Maximum allowed absence: 30% of practice classes.

ASSESSMENT

Cells of the appropriate type of requirement is to be filled out (course-units resulting in mid-term grade or examination). Cells of the other type can be deleted.

Course-unit with final examination

Mid-term assessments, performance evaluation and their weighting as a pre-requisite for taking the final exam

(The samples in the table to be deleted.)

Type	Assessment	*Weighting as a proportion of the pre-requisite for taking the exam*
1. ***Midterm Test 1***	*max. 100%*	*50 %*
2. ***Midterm Test 2***	*max. 100%*	*50 %*

Requirements for the end-of-semester signature

(Eg.: mid-term assessment of 40%)

Result of each midterm test : min. 40%.

Re-takes for the end-of-semester signature (PTE TVSz 50§(2))

The specific regulations for grade betterment and re-take must be read and applied according to the general Code of Studies and Examinations. E.g.: all the tests and the records to be submitted can be repeated/improved each at least once every semester, and the tests and home assignments can be repeated/improved at least once in the first two weeks of the examination period.

Each midterm test can be retaken one time during the semester.

Type of examination *(written, oral): oral*

The exam is successful if the result is minimum 40 %. *(The minimum cannot exceed 40%.)*

Calculation of the grade *(TVSz 47§ (3))*

The mid-term performance accounts for ***25*** %, the performance at the exam accounts for ***75*** % in the calculation of the final grade.

Calculation of the final grade based on aggregate performance in percentage.

Course grade	Performance in %
excellent (5)	85 % …
good (4)	70 % ... 85 %
satisfactory (3)	55 % ... 70 %
pass (2)	40 % ... 55 %
fail (1)	below 40 %

The lower limit given at each grade belongs to that grade.

4. SPECIFIED LITERATURE

In order of relevance. (In Neptun ES: Instruction/Subject/Subject details/Syllabus/Literature)

COMPULSORY READING AND AVAILABILITY

[1.] A. V. Oppenheim, A. S. Willsky: Signals and systems, Prentice-Hall, 1982

RECOMMENDED LITERATURE AND AVAILABILITY

[2.] S. Haykin, B. Van Veen: Signals and Systems, John Wiley and Sons, 1999
[3.] S. T. Karris: Signals and Systems with MATLAB Computing and Simulink Modeling (Fourth Edition), Orchard Publications, 2008