COURSE SYLLABUS AND COURSE REQUIREMENTS
2023/2024 SEMESTER II.

Course title	*Information Theory*
Course Code	IVB022ANMI
Hours/Week: le/pr/lab	2/0/0
Credits	4
Degree Programme	Computer Science Eng. (BSc)
Study Mode	full-time
Requirements	term grade
Teaching Period	spring
Prerequisites	-
Department(s)	Dept. of Technical Informatics
Course Director	Dr. Sári Zoltán
Teaching Staff	Landek Nikoletta, Dr. Sári Zoltán

COURSE DESCRIPTION

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

The fundamental concepts of information theory, interpretation and measuring of information. The concept of entropy, conditional entropy, mutual information. Model of the communication channel, source coding, channel coding. Source coding theorem, Shannon-Fano code, Huffman code, Lempel-Ziv code. The fundamentals of channel coding. Properties and representation of channels, channel capacity, binary symmetric channel. Linear codes their construction and properties, binary Hamming-code, error correction, syndrome decoding. Channel coding theorem.

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 gives an introduction into information theory, and its possible applications to communication systems. The topics covered include fundamentals of information theory, concept of entropy, lossy and lossless compression, basic model of communication, source coding and channel coding.

The objectives of this course:

Upon completion of this course the student should be able to: interpret, and put into practice
- the fundamental concepts of information theory,
- interpretation and measurement of information,
- model of communication, role of source- and channel coding,
- concepts and methods of lossless and lossy data compression,
- concept of communication over noisy channels.

2. COURSE CONTENT

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

	TOPICS
LECTURE	1. *Fundamental concepts of information theory, interpretation and measurement of information* 2. *Concept of entropy, conditional entropy, mutual information* 3. *Basic model of communication, the role of source coding and channel coding.* 4. *The source coding theorem.* 5. *Shannon-Fano code, Lempel-Ziv code.*

6. *Fundamentals of channel coding, properties of channels*
7. *Error detection and error correction, error correcting codes, principles of decoding.*
8. *Channel coding theorem*

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.	Introduction to the subject, recap and summarize relevant topics of probability theory	[1.] 3 - 47		
2.	Fundamental concepts of information theory, interpretation, and measurement of information	[1.] 3 - 47		
3.	Concept of entropy, properties, and applications	[1.] 3 - 47		
4.	Fundamentals of data compression	[1.] 65 - 131		
5.	Lossy compression, source coding theorem	[1.] 65 - 131		
6.	Lossless compression, symbol codes and their properties	[1.] 65 - 131		
7.	Stream codes, arithmetic code, Lempel-Ziv code	[1.] 65 - 131		
8.			**Midterm Test 1.**	
9.	Fundamentals of communication over a noisy channel, conditional entropy, mutual information	[1.] 137 - 170		
10.	Channel models, channel capacity	[1.] 137 - 170		
11.	Communication over a noisy channel, error correcting, Channel coding theorem	[1.] 137 - 170		
12.			**Midterm Test 2.**	
13.	Consultation			
14.			**Retakes**	
15.				

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. Maximum allowed absence: 30%.

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 resulting in mid-term grade *(PTE TVSz 40§(3))*

Mid-term assessments, performance evaluation and their ratio in the final grade *(The samples in the table to be deleted.)*

Type	**Assessment**	**Ratio in the final grade**

Midterm Test 1	*max. 100%*	*50%*
Midterm Test 2	*max. 100%*	*50%*

Opportunity and procedure for re-takes (PTE TVSz 47§(4))

The specific regulations for improving grades and resitting tests must be read and applied according to the general Code of Studies and Examinations. E.g.: all tests and assessment tasks can be repeated/improved 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.

Grade calculation as a percentage

based on the aggregate performance according to the following table

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.] David J.C. MacKay: Information Theory, Inference, and Learning Algorithms, 2003

RECOMMENDED LITERATURE AND AVAILABILITY

[2.] Thomas M. Cover, Joy A. Thomas: Elements of Information Theory, Wiley, 2006