COURSE SYLLABUS

Academic year 2024-2025

1. Programme Information

1.1. Higher education institution	**Lucian Blaga University of Sibiu**
1.2. Faculty	Faculty of Engineering
1.3. Department	Department of Computer Science and Electrical and Electronics Engineering
1.4. Field of study	Computer Science and Information Technology
1.5. Level of study[1]	Master
1.6. Programme of study/qualification	ADVANCED COMPUTING SYSTEMS

2. Course Information

2.1. Name of course	Advanced Compression Methods	Code	ACS.203.RO
2.2. Course coordinator	Assoc. Prof. Macarie BREAZU, PhD		
2.3. Seminar/laboratory coordinator	Assoc. Prof. Macarie BREAZU, PhD		

2.4. Year of study[2]	1	2.5. Semester[3]	2	2.6. Evaluation form[4]	E
2.7. Course type[5]	O	2.8. The formative category of the course[6]			R

3. Estimated Total Time

3.1. Course Extension within the Curriculum – Number of Hours per Week					
3.1.a. Lecture	3.1.b. Seminar	3.1.c. Laboratory	3.1.d. Project	3.1.e. Other	Total
2	0	2	0	0	**4**
3.2. Course Extension within the Curriculum – Total Number of Hours within the Curriculum					
3.2.a. Lecture	3.2.b. Seminar	3.2.c. Laboratory	3.2.d. Project	3.2.e. Other	Total[7]
28	0	28	0	0	**56**

Time Distribution for Individual Study[8]	**Hours**
Learning by using course materials, references and personal notes	10
Additional learning by using library facilities, electronic databases and on-site information	11
Preparing seminars / laboratories, homework, portfolios and essays	56
Tutorial activities[9]	14
Exams[10]	3
3.3. Total Individual Study Hours[11] ($NOSI_{sem}$)	**94**
3.4. Total Hours in the Curriculum ($NOAD_{sem}$)	**56**
3.5. Total Hours per Semester[12] ($NOAD_{sem} + NOSI_{sem}$)	**150**
3.6. No. of Hours / ECTS	**25**
3.7. Number of credits[13]	**6**

4. Prerequisites (if needed)

4.1. Courses that must be successfully completed first (from the curriculum)[14]	
4.2. Competencies	Fundamental data compression methods

5. Conditions (where applicable)

5.1. For course/lectures[15]	video projector, internet access
5.2. For practical activities (lab/sem/pr/app)[16]	Computer network, internet access

6. Specific competencies acquired[17]

Number of credits assigned to the discipline[18]		6	Credits distribution by competencies[19]
6.1. Professional competencies	PC2	analyses test data	1
	PC3	analyses massive groups of data	1
	PC11	develop data processing applications	1
	PC21	interpret current data	1
	PC28	performs data analysis	1
	PC31	establishes data processes	1
6.2. Transversal competencies			

7. Course objectives (resulted from developed competencies)

7.1. Main course objective	The students must understand the state-of-the-art compression methods and be able to implement some and use the specific tools available. Also, the students must develop good research skills in this field.
7.2. Specific course objectives	• knowledge and proper operation of discipline-specific advanced concepts • usage of a variety of strategies, methods, techniques for design, implementation and evaluation • developing of a positive attitude towards (the need for validation of the theoretical aspects by) a practical application

8. Content

8.1 Lectures[20]		**Teaching methods[21]**	**Hours**
Lecture 1	Data compression. Introduction. Classification. History. Image, audio and video formats.	Exposition	2
Lecture 2	Statistical coding. Variable length coding. Arithmetic and Huffman coding.	Exposition	2
Lecture 3	Predictive coding. Lossless and near-lossless coding. JPEG-LS.	Exposition	2
Lecture 4	Principles of audio-video compression: predictive coding, transform-based coding, motion compensation.	Exposition	2
Lecture 5	Vector Quantization. Building dictionaries. Variants.	Exposition	2
Lecture 6	Fractal Image Compression. Speeding-up methods.	Exposition	2
Lecture 7	Subband coding. Wavelet transform. EZW, SPIHT, EBCOT algorithms.	Exposition	2
Lecture 8	Still image compression – JPEG and JPEG2000.	Exposition	2
Lecture 9	H.261 – coding for videoconferencing. Macroblocks.	Exposition	2
Lecture 10	MPEG-1 – coding for digital storage media. Structure. Coding of I, P and B pictures. Motion compensation.	Exposition	2

Lecture 11	MPEG-2 – high quality video coding. Differences to MPEG-1. Scalable and nonscalable modes.	Exposition	2
Lecture 12	H.263 – coding for low bit rate communications. Differences to H.261 and MPEG-1. Advanced motion compensation. Treatment of B pictures. Protection against error. H.26L.	Exposition	2
Lecture 13	Audio coding. Psychoacoustic models. MPEG layer II, III (MP3) and Dolby AC3 audio coding.	Exposition	2
Lecture 14	MPEG-4 – content based video coding. Image segmentation. Shape coding. MPEG-7 and MPEG-21 – Content description, search and delivery	Exposition	2
	Total lecture hours:		**28**

8.2 Practical activities

8.2.b. Laboratory		**Teaching methods**[22]	**Hours**
Laboratory 1	Implementation of a library of functions for bit-level file access	Exercise	2
Laboratory 2	Implementation of an arithmetic coder	Exercise	2
Laboratory 3	Implementation of an arithmetic coder	Exercise	2
Laboratory 4	Implementation of an arithmetic coder	Exercise	2
Laboratory 5	Implementation of a near-lossless predictive coder	Exercise	2
Laboratory 6	Implementation of a near-lossless predictive coder	Exercise	2
Laboratory 7	Implementation of a near-lossless predictive coder	Exercise	2
Laboratory 8	Implementation of a fractal coder	Exercise	2
Laboratory 9	Implementation of a fractal coder	Exercise	2
Laboratory 10	Implementation of a fractal coder	Exercise	2
Laboratory 11	Implementation of a wavelet-based coder	Exercise	2
Laboratory 12	Implementation of a wavelet-based coder	Exercise	2
Laboratory 13	Implementation of a wavelet-based coder	Exercise	2
Laboratory 14	Evaluation of programs	Exercise	2
	Total laboratory hours:		28

9. Bibliography

9.1. Recommended Bibliography	1. Khalid Sayood, *"Introduction to Data Compression"*, Fifth Edition, ISBN: 978-0-12-809474-7, Morgan Kaufmann, 2018
	2. Jens-Rainer Ohm, *"Multimedia Signal Coding and Transmission"*, Signals and Communication Technology Series, ISBN: 978-3-662-46690-2, Springer-Verlag Berlin Heidelberg, 2015
	3. David Salomon, *"Data Compression: The Complete Reference"*, Fourth Edition, ISBN 1846286026, Springer, 2007, ULBS library code: 04/S17
	4. Mohammed Ghanbari, *"Standard Codecs: Image Compression to Advanced Video Coding"*, ISBN 0852967101, The Institute of Electrical Engineers, IEE, London, 2003
	5. http://webspace.ulbsibiu.ro/macarie.breazu/ACM.htm
9.2. Additional Bibliography	1. Breazu M., *"Tehnici fractale şi neuronale în compresia de imagini"*, Editura Universitatii „Lucian Blaga" din Sibiu, ISBN 973-739-251-5, Sibiu, 2006, ULBS library code: 04/B76

10. Conjunction of the discipline's content with the expectations of the epistemic community, professional associations and significant employers of the specific study program[23]

By periodic formal and informal meetings with members of companies in the field.

11. Evaluation

Activity Type	11.1 Evaluation Criteria	11.2 Evaluation Methods		11.3 Percentage in the Final Grade	Obs.[24]
11.4a Exam / Colloquy	• Theoretical and practical knowledge acquired (quantity, correctness, accuracy)	Tests during the semester[25]:	0%	50%	CEF
		Homework:	0%		
		Other activities[26]:	0%		
		Final evaluation:	100%		
11.4c Laboratory	• Knowledge of the equipment, how to use specific tools; evaluation of tools, processing and interpretation of results	• Written questionnaire • Oral response • Laboratory notebook, experimental works, reports, etc. • Practical demonstration		50%	CEF
11.5 Minimum performance standard[27] 4.50 grade at each component					

The Course Syllabus will encompass components adapted to persons with special educational needs (SEN – people with disabilities and people with high potential), depending on their type and degree, at the level of all curricular elements (skills, objectives, contents, teaching methods, alternative assessment), in order to ensure fair opportunities in the academic training of all students, paying close attention to individual learning needs.

Filling Date: 11.09.2024

Department Acceptance Date: 16.09.2024

	Academic Rank, Title, First Name, Last Name	Signature
Course Teacher	Assoc. Prof. Macarie BREAZU, PhD	
Study Program Coordinator	Prof. Adrian FLOREA, PhD	
Head of Department	Assoc. Prof. Radu George CREȚULESCU, PhD	
Dean	Prof. Maria VINȚAN, PhD	

[1] *Bachelor / Master*
[2] *1-4 for bachelor, 1-2 for master*
[3] *1-8 for bachelor, 1-3 for master*
[4] *Exam, colloquium or VP A/R - from the curriculum*
[5] *Course type: R = Compulsory course; E = Elective course; O = Optional course*
[6] *Formative category: S = Specialty; F = Fundamental; C = Complementary; I = Fully assisted; P = Partially assisted; N = Unassisted*
[7] *Equal to 14 weeks x number of hours from point 3.1 (similar to 3.2.a.b.c.)*
[8] *The following lines refer to individual study; the total is completed at point 3.37.*
[9] *Between 7 and 14 hours*
[10] *Between 2 and 6 hours*
[11] *The sum of the values from the previous lines, which refer to individual study.*
[12] *The sum (3.5.) between the number of hours of direct teaching activity (NOAD) and the number of hours of individual study (NOSI) must be equal to the number of credits assigned to the discipline (point 3.7) x no. hours per credit (3.6.)*
[13] *The credit number is computed according to the following formula, being rounded to whole neighbouring values (either by subtraction or addition*

$$No.credits = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credits$$

Where:

- NOCpSpD = Number of lecture hours / week / discipline for which the credits are calculated
- NOApSpD = Number of application hours (sem./lab./pro.) / week / discipline for which the credits are calculated
- TOCpSdP = Total number of course hours / week in the Curriculum
- TOApSdP = Total number of application hours (sem./lab./pro.) / week in the Curriculum
- C_C/C_A = Course coefficients / applications calculated according to the table

Coefficients	**Course**	**Applications (S/L/P)**
Bachelor	2	1
Master	2,5	1,5
Bachelor - foreign language	2,5	1,25

[14] *The courses that should have been previously completed or equivalent will be mentioned*
[15] *Board, video projector, flipchart, specific teaching materials, online platforms, etc.*
[16] *Computing technology, software packages, experimental stands, online platforms, etc.*
[17] *Competences from the Grids related to the description of the study program, adapted to the specifics of the discipline*
[18] *From the curriculum*
[19] *The credits allocated to the course are distributed across professional and transversal competences according to the specifics of the discipline*
[20] *Chapter and paragraph titles*
[21] *Exposition, lecture, board presentation of the studied topic, use of video projector, discussions with students (for each chapter, if applicable)*
[22] *Practical demonstration, exercise, experiment*
[23] *The relationship with other disciplines, the usefulness of the discipline on the labour market*
[24] *CPE – Conditions Exam Participation; nCPE – Does Not Condition Exam Participation; CEF - Conditions Final Evaluation; N/A – not applicable*
[25] *The number of tests and the weeks in which they will be taken will be specified*
[26] *Scientific circles, professional competitions, etc.*
[27] *The minimum performance standard in the competence grid of the study program is customized to the specifics of the discipline, if applicable*