ECTS COURSE INFORMATION FORM

Faculty	**Faculty of Engineering**	
	B.Sc. in Civil Engineering	**Elective**
	B.Sc. in Computer Engineering	**Elective**
	B.Sc. in Electrical-Electronics Engineering	**Elective**
	B.Sc. in Industrial Engineering	**Elective**
	B.Sc. in Mechanical Engineering	**Elective**

Course Code	COMP 490			
Course Title in English	Introduction to Information and Coding Theory			
Course Title in Turkish	Bilgi ve Kodlama Kuramına Giriş			
Language of Instruction	English			
Type of Course	Flipped Classroom			
Level of Course	Undergraduate			
Course Category (by % of Content)	Basic Science	Basic Engineering	Engineering Design	General Education
	80	15	5	-
Semester Offered	Fall			
Contact Hours per Week	Lecture:3 hours	Recitation:-	Lab:-	Other:-
Estimated Student Workload	150 hours			
Number of Credits	6 ECTS			
Grading Mode	Standard Letter Grade			
Pre-requisites	N/A			
Expected Prior Knowledge	Probability Theory, Linear Algebra, Any Programming Language.			
Co-requisites	None			
Registration Restrictions	Undergraduate Students/Junior Graduate Students			
Overall Educational Objective	To learn about fundamentals of information theory, source and channel coding and practical constructions towards achieving goals set by the theory.			
Course Description	This course will introduce basic mathematical principles behind data compression and data protection for efficiency and high failure tolerance. The theory of information will be broken down to learning the concepts of entropy, mutual information, channel capacity, source and channel coding at an introductory level. Basic Gaussian as well as some discrete symmetric source and channel models will be considered. The fundamental limits of data compression and data transmission will be examined using the techniques introduced in this class. The course will also cover designing practical coding algorithms such as Huffman and standard deterministic and probabilistic block codes with the details of encoding and decoding algorithms.			
Course Description in Turkish	Bu derste, verimli ve yüksek hata dayanıklılığı için veri sıkıştırmasının ve veri korunumunun temel matematiksel prensiplerinden bahsedilecektir. Bilgi kuramı başlangıç seviyesinde, entropi kavramı, müşterek bilgi, kanal kapasitesi, kaynak ve kanal kodlama gibi kuramlara bölünerek incelenecektir. Temel Gauss ve bazı ayrışık simetrik kaynak ve kanal modelleri düşünülecektir. Veri sıkıştırması ve veri iletişiminin temel üst sınırlarını öğrenilen tekniklerle belli başlı kanallar için belirlenecektir. Ayrıca bu derste pratik kodlama ve algoritma tasarımı öğrenilecektir. Bu pratik algoritmalar Huffman kodlama ve standart deterministik ve rastgele blok kodlama teknikleri ve bunların şifreleme ve deşifreleme yöntemlerini içerecektir.			
Course Learning Outcomes and Competences	Upon successful completion of the course, the learner is expected to: 1. express the basic mathematical foundations of information theory; 2. express the basic mathematical foundations of source coding; 3. express the basic mathematical foundations of channel coding; 4. construct error correction codes to achieve the optimality;			

	5. design practical algorithms for encoding and decoding; 6. discuss the impact of error correction using applications in broader engineering disciplines.

Relationship of the Course with the Student Outcomes	Level	Learning Outcome(s)	Assessed by
Student Outcomes	N=None S=Supportive H=High		Exam, Project, HW, Experiment, Presentation, etc.
(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	H	1,2,3	Midterms, Quizzes, HWs, Project
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	H	4,5	Midterms, Quizzes, HWs, Project
(3) an ability to communicate effectively with a range of audiences			
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts			
(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives			
(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions			
(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	S	6	Project

Prepared by and Date	Assoc. Prof. Dr. Şuayb Ş. Arslan / June 2019	
Semester	Fall 2019-2020	
Name of Instructor	Assoc. Prof. Dr. Şuayb Ş. Arslan	
Course Contents	Week	Topic
	1.	Introduction to Information Theory and Entropy
	2.	Law of large numbers and AEP
	3.	Convexity and Jensen’s inequality
	4.	Source Coding
	5.	Basic bounds and type of source codes
	6.	Variable length source coding: Huffman Coding
	7.	Arithmetic Coding / Midterm 1
	8.	Conditional Entropy
	9.	Mutual information
	10.	Basic Channel Coding I
	11.	Basic Channel Coding II
	12.	Introduction to Block Codes / Midterm 2
	13.	Hamming/Hadamard Codes
	14.	Random/Probabilistic Coding
	15.	Final Exam/Project/Presentation
	16.	Final Exam/Project/Presentation

Required/Recommended Readings	Thomas M. Cover and Joy A. Thomas. 2006. *Elements of Information Theory (Wiley Series in Telecommunications and Signal Processing)*. Wiley-Interscience. Also some course related documents will be posted on a regular basis.
Teaching Methods	Lectures/contact hours using 'flipped classroom'
Homework and Projects	4 Homework and 1 project
Laboratory Work	N/A
Computer Use	Required
Other Activities	Report writing for the project.
Assessment Methods	Types of assessment — Number — Ratio (%) Midterm Exams — 2 — 40 (each contributing 20%) Quizzes/in-class exercises — 5 — 15 (each contributing 3%) Homework — 4 — 24 (each contributing 6%) Term Project — 1 — 21 Total — 100
Course Administration	**Instructor's office and phone number, office hours, email address:** - Office: 5th Floor, right across the entrance. - Phone number: 0212 395 3735 - Email address: arslans@mef.edu.tr **Rules for attendance, late submissions, missing an exam, etc.:** Attendance is not enforced by any means and yet it is highly encouraged for getting a successful letter grade. Late submissions may end up in 5 points penalty for each day past the deadline. Provided that proper documents are presented, each missed midterm by the student will be given the grade of the final exam. No make-up exam shall be given. **A reminder of proper classroom behavior, code of student conduct:** YÖK regulations. **Statement on plagiarism:** Plagiarism or any type of ethical misconduct shall not be tolerated. For more information, please see the corresponding YÖK regulations.

ECTS Student Workload Estimation

Activity	No/Weeks	Hours			Calculation	Explanation
	No/Weeks per Semester (A)	Preparing for the Activity (B)	Spent in the Activity Itself (C)	Completing the Activity Requirements (D)		
Lecture/Flipped Classroom	14	3	2.5	0	77	A*(B+C+D)
Midterm(s)	2	15	2	0	34	A*(B+C+D)
Labs						
Term Project	1	3	10	0	13	A*(B+C+D)
HWs	4	5	1.5	0	26	A*(B+C+D)
Final Examination						A*(B+C+D)
Total Workload					150	
Total Workload/25					6	
ECTS					**6**	