ÇANKAYA UNIVERSITY
Faculty of Engineering
Course Definition Form

This form should be used for either an elective or a compulsory course being proposed and curricula development processes for an undergraduate curriculum at Çankaya University, Faculty of Engineering. Please fill in the form completely and submit the printed copy containing the approval of the Department Chair to the Dean's Office, and mail its electronic copy to mdozgor@cankaya.edu.tr Upon the receipt of *both copies*, the printed copy will be forwarded to the Faculty Academic Board for approval. Incomplete forms will be returned to the Department. The approved form is finally sent to the President's office for approval by the Senate.

Part I. Basic Course Information

Department Name						**Dept. Numeric Code**	14
Course Code	ECE 556	**Number of Weekly Lecture Hours**	3	**Number of Weekly Lab/Tutorial Hours**	0	**Number of Credit Hours**	3
Course Web Site	http://ECE556.cankaya.edu.tr					**ECTS Credit**	75

Course Name *This information will appear in the printed catalogs and on the web online catalog.*	
English Name	BASICS OF DIGITAL SPEECH PROCESSING
Turkish Name	SAYISAL KONUŞMA İŞLEMENİN TEMELLERİ

Course Description
Provide a brief overview of what is covered during the semester. This information will appear in the printed catalogs and on the web online catalog. Maximum 60 words.

Course gives fundamentals of digital speech processing and its applications in communications. Digital speech modeling, parametric models. Speech analysis, parameter estimation for vocal tract model and excitation model. Most important speech models and their properties. Speech coding and applications. Fundementals of speech recognition, feature vectors, Cepstral analysis. Statistical models, training procedures for statistical models. Hidden Markov Model, Gaussian Mixture Model, Acoustical and lexical models. Speech synthesis, Examples of systems for speech coding, recognition and synthesis

Prerequisites (if any) *Give course codes and check all that are applicable.*	1st	2nd	3rd	4th
	☐ Consent of the Instructor	☐ Senior Standing	☐ Give others, if any.	
Co-requisites (if any)	1st	2nd	3rd	4th
Course Type *Check all that are applicable*	☐ Must course for dept.	☐ Must course for other dept.(s)	☐ Elective course for dept.	☐ Elective course for other dept.(s)

Course Classification
Give the appropriate percentages for each category.

Category	Mathematics & Natural Sciences	Engineering Sciences	Engineering Design	General Education	Other
Percentage	40	30	30		

Part II. Detailed Course Information

Course Objectives
Explain the aims of the course. Maximum 100 words.

The objective is understanding of theory of signal processing applications on speech, to give information about human speech production and perception, voice production mechanism, human perception systems, Probabilistic and Stochastic Processes on speech processing, time frequency analysis of speech, Linear Predictive Coding, speech analysis/synthesis. Ability to develop computer aided projects and to conduct research

Learning Outcomes
Explain the learning outcomes of the course. Maximum 10 items.

1. Learn basics of mechanisms of speech processing systems
2. Express the speech signal in time domain and frequency domain
3. Analyze operation of speech processing systems
4. Analyze the signal outcomes of components of speech modelling with software programs

Textbook(s)
List the textbook(s), if any, and other related main course materials.

Author(s)	Title	Publisher	Publication Year	ISBN
Rabiner, L., Schafer,R	Introduction to Digital speech Processing	Publishers Inc.	2007	ISBN : 978-1-60198-070-0

Reference Books
List the reference books as supplementary materials, if any.

Author(s)	Title	Publisher	Publication Year	ISBN
Rabiner, L., Schafer,R	Theory and Applications of Speech Processing	Pearson	2011	ISBN:978-0136034285
Gopi, E.S.	Digital Speech Processing using MATLAB	Springer	2014	ISBN: 78-8132216766
Quatieri, T	Discrete Time speech Signal Processing	Prentice Hall	2002	ISBN: 978-013242942

Teaching Policy
Explain how you will organize the course (lectures, laboratories, tutorials, studio work, seminars, etc.)

3 hours of lecturing, Term project supported with software based applications

Laboratory/Studio Work
Give the number of laboratory/studio hours required per week, if any, to do supervised laboratory/studio work, and list the names of the laboratories/studios in which these sessions will be conducted.

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Computer Usage
Briefly describe the computer usage and the hardware/software requirements in the course.

For a good understanding of speech processing theory, as well as the scientific research on a topic, software programs (with MATLAB, C, etc.) will be designed

Course Outline
List the topics covered within each week.

Week	Topic(s)
1	Digital Signal Processing Review, Sampling & quantization
2	Speech spectrum Estimation, Fourier Transform, power spectral density
3	The Basic Units of Speech, speech production and perception
4	vocal tract modelling, Linear-Predictive Coding
5	Time domain and frequency-domain representation
6	The Levinson Durbin Recursion, Cepstral analysis,
7	Introduction to Speech coding principles
8	Estimating speech parameters
9	Vocoders and Spectrograms
10	Scalar and vector quantization
11	Introduction to Automatic Speech Recognition
12	Template matching, feature extraction principles
13	Hidden Markov Model, Gaussian Mixture Model
14	Speech Synthesis Techniques

Grading Policy
List the assessment tools and their percentages that may give an idea about their relative importance to the end-of-semester grade.

Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage	Assessment Tool	Quantity	Percentage
Homework	1	05	Case Study			Attendance		
Quiz			Lab Work			Field Study		
Midterm Exam	1	35	Class Participation			Project		
Term Paper	1	10	Oral Presentation			Final Exam	1	50

ECTS Workload
List all the activities considered under the ECTS.

Activity	Quantity	Duration (hours)	Total Workload (hours)
Attending Lectures (*weekly basis*)	14	3	42
Attending Labs/Recitations (*weekly basis*)	-	-	-
Preparation beforehand and finalizing of notes (*weekly basis*)	14	4	56
Collection and selection of relevant material (*once*)	1	4	4
Self study of relevant material (*weekly basis*)	14	3	42
Homework assignments	1	8	8
Preparation for Quizzes	-	-	-
Preparation for Midterm Exams (*including the duration of the exams*)	1	12	12
Preparation of Term Paper/Case Study Report (*including oral presentation*)	1	12	12
Preparation of Term Project/Field Study Report (*including oral presentation*)	-	-	-
Preparation for Final Exam (*including the duration of the exam*)	1	12	12
		TOTAL WORKLOAD / 25	7,52
		ECTS Credit	**7.5**

Total Workloads are calculated automatically by formulas. To update all the formulas in the document first press CTRL+A and then press F9.

Program Qualifications vs. Learning Outcomes

Consider the below program qualifications determined in terms of learning outcomes of all the courses in the curriculum and capabilities. Look at the learning outcomes of this course given above. Relate these two using the Likert Scale by marking with X in one of the five choices at the right.

No	Program Qualifications	Contribution				
		0	1	2	3	4
ECE-01	Adequate knowledge in mathematics, science and engineering subjects pertaining to Electronics and Communication Engineering; Engineering; ability to use theoretical and applied information in these areas to model and solve Electronics and Communication Engineering problems.					X
ECE-02	Ability to identify and define complex Electronics and Communication Engineering problems; ability to select and apply proper analysis tools and methods and modeling techniques for formulating and solving such problems.					X
ECE-03	Ability to analyze a complex system and/or a subsystem or a process and ability to design it under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern systems design methods for this purpose.				X	
ECE-04	Ability to devise, select, and use modern techniques and computing tools needed for Electronics and Communication Engineering practice; ability to employ and make use of information technologies effectively with the knowledge of state-of-the art hardware but mostly software capabilities related to Electronics and Communication Engineering.				X	
ECE-05	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems in general and for systems analysis, design, implementation and continuous improvement from Electronics and Communication Engineering perspective in particular.					X
ECE-06	Ability to search data bases and other information resources effectively; ability to identify and extract the required information and required information from literature and other open sources.				X	
ECE-07	Ability to work individually, to take independent initiatives, to create original inferences and to work in teams efficiently; ability to collaborate effectively in intra-disciplinary and multi-disciplinary teams; ability to take responsibility within teams.			X		
ECE-08	Ability to communicate effectively in Turkish, both orally and in writing and knowledge of a minimum of one foreign language (English in particular)at a fluency level enough to follow easily Electronics and Communication Engineering knowledge presented in that language and enough to communicate effectively with colleagues.			X		
ECE-09	Ability to report findings, conclusion and interpretations related to a project, ability to write technical reports, to prepare and conduct effective presentations.				X	
ECE-10	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to keep continuous self-improvement.				X	
ECE-11	Awareness of professional and ethical responsibility issues and their legal consequences.			X		
ECE-12	Awareness of environmental issues, occupational safety and health, and their legal consequences.		X			
ECE-13	Knowledge about contemporary issues and the global and social effects of engineering practices; awareness of the legal consequences of engineering solutions; awareness of entrepreneurship, innovation, and sustainable development			X		

Contribution Scale to a Qualification: **0**-None, **1**-Little, **2**-Medium, **3**-Considerable, **4**-Largest

Part III New Course Proposal Information

State only if it is a new course

Is the new course **replacing** a former course in the curriculum**?**	Yes ☐	No ☐	Former Course's Code	Former Course's Name
Is there any similar course which has content **overlap** with other courses offered by the university**?**	Yes ☐	No ☐	Most Similar Course's Code	Most Similar Course's Name
Frequency of Offerings *Check all semesters that the course is planned to be offered.*	☐ Fall	☐ Spring	☐ Summer	
First Offering	Academic Year 2016/2017		Semester ☐ Fall	☐ Spring
Maximum **Class Size** Proposed	15	Student **Quota** for Other Departments	2	Approximate **Number of Students** Expected to Take the Course: 15
Justification for the proposal *Maximum 80 words*				

Speech processing has been one of the main application areas of digital signal processing for several decades now such as voice over IP, automated call centres, man-machine interaction and biometrics. This course provides not only the technical details of ubiquitous techniques like linear predictive coding, Mel frequency cepstral coefficients, Gaussian mixture models and hidden Markov models, but the rationale behind their application to speech and an understanding of speech as a signal. Contemporary signal processing is almost entirely digital, hence only discrete-time theory is presented in this course. MATLAB applications will be done for good understanding of the theory.

Part IV Approval

	Faculty Member *Give the Academic Title first.*	Signature	Date
Proposed by			
	Asst.Prof.Dr. Selma ÖZAYDIN		20.12.2016

Departmental Board Meeting Date		Meeting Number		Decision Number	
Department Chair	Prof.Dr.Yusuf Ziya UMUL	Signature		Date	

Graduate School of Naturel and Applied Sciences Administrative Committee Meeting Date		Meeting Number		Decision Number	
Director	Prof.Dr.Halil EYYUBOĞLU	Signature		Date	

Senate Meeting Date		Meeting Number		Decision Number	