

## Module Template for New and Revised Modules<sup>1</sup>

<b>Module Code</b>	EE5C4
<b>Module Name</b>	Speech and Audio Engineering
<b>ECTS Weighting<sup>2</sup></b>	5 ECTS
<b>Semester taught</b>	Semester 1
<b>Module Coordinator/s</b>	Associate Professor Naomi Harte
<b><u>Module Learning Outcomes</u> with reference to the <u>Graduate Attributes</u> and how they are developed in discipline</b>	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Describe, in terms of signal processing, the functioning of the human vocal and auditory systems</p> <p>LO2. Explain the frequency characteristics of speech signals</p> <p>LO3. Explain non-uniform frequency bands and metrics such as mel scales and dBA</p> <p>LO4. Explain the role of binaural hearing in distinguishing the direction of an acoustic source</p> <p>LO5. Apply machine learning techniques to develop a speech processing application in speech recognition, speaker identification or other similar domain</p> <p>LO6. Analyse the function of feature extraction in speech and audio signal processing</p> <p>LO7. Assess and explore speech technology through relevant literature in the domain</p> <p><b>Graduate Attributes: levels of attainment</b></p> <p>To act responsibly - Attained</p> <p>To think independently - Attained</p> <p>To develop continuously - Attained</p> <p>To communicate effectively - Attained</p>

---

<sup>1</sup> [An Introduction to Module Design](#) from AISHE provides a great deal of information on designing and re-designing modules.

<sup>2</sup> [TEP Glossary](#)

<b>Module Content</b>	<p>Speech is the most important and pervasive form of communication. Speech Engineering requires an understanding of the physiology of the human vocal and auditory systems. This understanding informs the signal processing methods that characterise speech signals. These methods include lossless tube models of speech production; time and frequency domain representations of speech; and window characteristics and time/frequency resolution trade-offs. Statistical signal processing methods such as autocorrelation and linear prediction of speech provide the basis of methods for speech synthesis and language processing. The module will introduce the underlying principles in speech technology such as speaker verification and speech synthesis, including how machine learning underpins much speech applications</p>																													
<b>Teaching and Learning Methods</b>	<p>For 2020/21, the taught component of this module uses a mixture of pre-recorded lectures made available in Blackboard and real-time sessions. These will be live and online during timetabled slots for 5C4. The students are expected to engage in extensive reading of both course texts and relevant literature.</p>																													
<b>Assessment Details<sup>3</sup></b> <b>Please include the following:</b> <ul style="list-style-type: none"> <li>• <b>Assessment Component</b></li> <li>• <b>Assessment description</b></li> <li>• <b>Learning Outcome(s) addressed</b></li> <li>• <b>% of total</b></li> <li>• <b>Assessment due date</b></li> </ul>	<table border="1"> <thead> <tr> <th data-bbox="651 947 878 1052">Assessment Component</th> <th data-bbox="883 947 1057 1052">Assessment Description</th> <th data-bbox="1062 947 1247 1052">LO Addressed</th> <th data-bbox="1252 947 1446 1052">% of total</th> <th data-bbox="1451 947 1585 1052">Week due</th> </tr> </thead> <tbody> <tr> <td data-bbox="651 1058 878 1276">CA</td> <td data-bbox="883 1058 1057 1276">Paper analysis and speech analysis exercises</td> <td data-bbox="1062 1058 1247 1276">All</td> <td data-bbox="1252 1058 1446 1276">25</td> <td data-bbox="1451 1058 1585 1276">10,12</td> </tr> <tr> <td data-bbox="651 1283 878 1415">Exam</td> <td data-bbox="883 1283 1057 1415">Exam</td> <td data-bbox="1062 1283 1247 1415">All</td> <td data-bbox="1252 1283 1446 1415">75</td> <td data-bbox="1451 1283 1585 1415">As per exam timetable</td> </tr> <tr> <td data-bbox="651 1421 878 1514"></td> <td data-bbox="883 1421 1057 1514"></td> <td data-bbox="1062 1421 1247 1514"></td> <td data-bbox="1252 1421 1446 1514"></td> <td data-bbox="1451 1421 1585 1514"></td> </tr> <tr> <td data-bbox="651 1520 878 1608"></td> <td data-bbox="883 1520 1057 1608"></td> <td data-bbox="1062 1520 1247 1608"></td> <td data-bbox="1252 1520 1446 1608"></td> <td data-bbox="1451 1520 1585 1608"></td> </tr> </tbody> </table>	Assessment Component	Assessment Description	LO Addressed	% of total	Week due	CA	Paper analysis and speech analysis exercises	All	25	10,12	Exam	Exam	All	75	As per exam timetable														
Assessment Component	Assessment Description	LO Addressed	% of total	Week due																										
CA	Paper analysis and speech analysis exercises	All	25	10,12																										
Exam	Exam	All	75	As per exam timetable																										
<b>Reassessment Requirements</b>	<p>Exam based</p>																													
<b>Contact Hours and Indicative Student Workload<sup>3</sup></b>	<p><b>Contact hours:</b> Approx 30 hours online</p>																													

<sup>3</sup> [TEP Guidelines on Workload and Assessment](#)

	<p><b>Independent Study (preparation for course and review of materials):</b> Approx 70 hours for online lecture listening and self guided study through Semester.</p> <hr/> <p><b>Independent Study (preparation for assessment, incl. completion of assessment):</b> Approx 30 hours for papers and assignment. Approx 20 hours of focussed study for the exam</p>
<p><b>Recommended Reading List</b></p>	<p>Main text: Theory and Applications of Digital Speech Processing Lawrence R. Rabiner, Ronald W. Schafer</p> <p>Extra reading in library: Fundamentals of Speech Recognition Lawrence Rabiner, B H Juang Speech Synthesis and Recognition, 2nd Edition John N. Holmes, Wendy J. Holmes Applied Speech and Audio processing, Ian McLaughlin, Cambridge University Press, 2009 Speech and Audio Signal Processing: Processing and Perception of Speech and Music, 2nd Edition, Ben Gold, Nelson Morgan, Dan Ellis, Wiley</p> <p>Other papers will be given as assigned reading during the course.</p>
<p><b>Module Pre-requisite</b></p>	<p>Note that EE4C5 or an equivalent level of Digital Signal Processing is required <u>before</u> a student can start this course.</p>
<p><b>Module Co-requisite</b></p>	
<p><b>Module Website</b></p>	<p>On Blackboard</p>
<p><b>Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.</b></p>	
<p><b>Module Approval Date</b></p>	
<p><b>Approved by</b></p>	
<p><b>Academic Start Year</b></p>	
<p><b>Academic Year of Date</b></p>	