Description: Advanced Digital Communications

Subject | Cat-Nbr | Class | Term | Mode | Units | Campus
------- | ------- | ----- | ---- |------ |------ |-----
ELE     | 4607    | 10609 | 1, 2002 | ONC | 1.00 | TWMS

Academic Group: FOENS
Academic Org: FOES04
HECS Band: 2
ASCED Code: 031307

STAFFING
Examiner: John Leis
Moderator: Nigel Hancock

PRE-REQUISITES
Pre-requisite: ELE 1301 Co-requisite: ELE 3107

SYNOPSIS
In recent times, digital transmission systems have been increasingly used for the transmission of analog signals such as audio and video. This has been brought about by the desire to transmit audio and images over the Internet and other mobile communications systems. This course examines, in some detail, the methods used for coding, transmitting and storing continuous signals such as speech, music, images and video. The approach taken is to examine the theoretical aspects of signal coding and transmission, with a view to current and emerging national and international standards in this area. Thus, an understanding of industry standards is underpinned by a sound theoretical basis. Implementation on Digital Signal Processor (DSP) systems and high-level coding of algorithms is a key aspect in this regard. The course also seeks to impart an understanding of current research problems in the digital communications field. It is thus suitable for students who may wish to undertake research and development work in this emerging field.

OBJECTIVES
On successful completion of this course students will be able to:

- Be able to describe quantization techniques, both linear and nonlinear.
- Be able to calculate the optimal quantizer characteristic for various probability distributions.
- Be able to calculate (or code algorithms to calculate) optimal and near-optimal lossless codes for various symbol probabilities.
• Be able to explain the concept of vector quantization, and be able to implement a vector quantizer in software.
• Have an understanding of mathematical transformations and their applicability to data coding.
• Be able to implement basic transform-domain encoders and decoders.
• Be able to describe, in detail, coding algorithms used in speech communications such as linear predictive coding and code-excited linear prediction.
• Be able to describe, in detail, coding algorithms used in video communications such as the discrete cosine transform and intraframe predictors.
• Be able to analyse the computational complexity of coding algorithms and assess their suitability for real-time implementation on DSP systems.
• Demonstrate an understanding of the applicability of international standards for data communications.
• Describe the principle standards associated with mobile and Internet audio/video transmission.
• Have an awareness of emerging research trends and standards in the data transmission field.

TOPICS

<table>
<thead>
<tr>
<th>Description</th>
<th>Weighting (%)</th>
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<tbody>
<tr>
<td>1. Principles of quantization</td>
<td>5.00</td>
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<tr>
<td>2. Mathematical transformations</td>
<td>5.00</td>
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<tr>
<td>3. Digital synthesis filters</td>
<td>5.00</td>
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<tr>
<td>4. Vector quantization</td>
<td>20.00</td>
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<tr>
<td>5. Audio signal modelling</td>
<td>20.00</td>
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<tr>
<td>6. Video signal modelling</td>
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<tr>
<td>7. Lossless coding algorithms</td>
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<td>8. DSP systems &amp; real-time implementation</td>
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<tr>
<td>9. Current &amp; proposed standards for digital communications</td>
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TEXT and MATERIALS required to be PURCHASED or ACCESSED:

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at http://bookshop.usq.edu.au by entering the author or title of the text.

Advanced Digital Communications Course Notes available via http://www.usq.edu.au/users/leis/
REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.


STUDENT WORKLOAD REQUIREMENTS

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>HOURS</th>
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<tbody>
<tr>
<td>Assessment</td>
<td>52</td>
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<tr>
<td>Examinations</td>
<td>3</td>
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<tr>
<td>Lectures</td>
<td>39</td>
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<tr>
<td>Private Study</td>
<td>61</td>
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ASSESSMENT DETAILS

<table>
<thead>
<tr>
<th>Description</th>
<th>Marks Out of</th>
<th>Wtg(%)</th>
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<th>Due Date</th>
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<tbody>
<tr>
<td>ASSIGNMENT 1</td>
<td>999.00</td>
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<td>Y</td>
<td>04 Mar 2002</td>
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<td>ASSIGNMENT 2</td>
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<td>3 HOUR CLOSED EXAMINATION</td>
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<td>(see note 3)</td>
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NOTES:
1. Further details about the due dates are detailed in the assessment section of the Course Specifications.
2. Further details about the due dates are detailed in the assessment section of the Course Specifications.
3. Further details about the due dates are detailed in the assessment section of the Course Specifications.

OTHER REQUIREMENTS

1. In order to complete this course successfully a student must normally obtain 50% of the marks in both the individual assessments and overall.
2. A basic competence in a high-level computer language is assumed.
3. A basic understanding of discrete-time algorithms and their implementation is assumed. This would normally be obtained via course ELE3107 Signal Processing.
4. Attendance at all site visits and specialist guest lectures is mandatory.
5. Students who wish to apply for an extension to any assignment due date must do so in writing before the due date.
6. Students are to retain a verbatim copy of all assignment work submitted for assessment. This must be produced within five days if required by the Examiner.
7. In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.
8. If students submit assignments after the due date without prior approval then a penalty of up to 10% of the total marks for the assignment will apply for each working day late.
A closed examination is an examination where the candidates are allowed to bring only writing and drawing instruments into the examination.

The final grades for students will be assigned on the basis of the aggregate of the marks.

The Faculty of Engineering and Surveying does not offer supplementary examinations.

Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded the temporary grade: IM (Incomplete - Make up). An IM grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non-directed personal study.

Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination; IDM (Incomplete Deferred Make-up; IDSM (Incomplete Deferred Examination and Make-up).

A minimum standard of communication skills must be demonstrated in order for a passing grade to be achieved.