Description: Advanced Digital Communications

<table>
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<tr>
<th>Subject</th>
<th>Cat-nbr</th>
<th>Class</th>
<th>Term</th>
<th>Mode</th>
<th>Units</th>
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<td>30540</td>
<td>1, 2004</td>
<td>ONC</td>
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Academic group: FOENS
Academic org: FOES04
Student contribution band: 2
ASCED code: 031307

STAFFING
Examiner: John Leis
Moderator: Nigel Hancock

REQUISITES
Pre-requisite: ELE1301

OTHER-REQUISITES
Recommended prior or concurrent study: ELE3107

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 completion of this course, students should 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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<tr>
<td>1. Principles of quantization</td>
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<tr>
<td>2. Mathematical transformations</td>
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<td>3. Digital synthesis filters</td>
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<td>4. Vector quantization</td>
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<td>5. Audio signal modelling</td>
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<td>6. Video signal modelling</td>
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<td>7. Lossless coding algorithms</td>
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<td>8. DSP systems &amp; real-time</td>
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<td>9. Current &amp; proposed standards</td>
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TEXT and MATERIALS required to be PURCHASED or ACCESSED:

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook
Search' facility at http://bookshop.usq.edu.au click 'Semester', then enter your 'Course Code' (no spaces).


**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>
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<tbody>
<tr>
<td>Assessment</td>
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<tr>
<td>Examinations</td>
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<td>Lectures</td>
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<td>Private Study</td>
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ASSESSMENT DETAILS

<table>
<thead>
<tr>
<th>Description</th>
<th>Marks out of</th>
<th>Wtg(%)</th>
<th>Due date</th>
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<tr>
<td>ASSIGNMENT 1</td>
<td>200.00</td>
<td>20.00</td>
<td>02 Apr 2004</td>
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<td>ASSIGNMENT 2</td>
<td>200.00</td>
<td>20.00</td>
<td>04 Jun 2004</td>
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<td>3 HOUR CLOSED EXAMINATION</td>
<td>600.00</td>
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NOTES:
1. Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

1. Attendance requirements:
   It is the students' responsibility to attend and participate appropriately in all activities (such as lectures, tutorials, laboratories and practical work) scheduled for them, and to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2. Requirements for students to complete each assessment item satisfactorily:
   (i) To complete each of the assignments satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for each assignment.
   (ii) To complete the examination satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for the examination.

3. Penalties for late submission of required work:
   If students submit assignments after the due date without prior approval then a penalty of 10% of the total marks available for the assignment will apply for each working day late.

4. Requirements for student to be awarded a passing grade in the course:
   To be assured of a passing grade, students must demonstrate, via the summative assessment items, that they have achieved the required minimum standards in relation to the objectives of the course by: (i) satisfactorily completing the examination and assignments; and (ii) obtaining at least 50% of the total weighted marks available for all summative assessment items.

5. Method used to combine assessment results to attain final grade:
The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.

6 Examination information:
In a Closed Examination, candidates are allowed to bring only writing and drawing instruments into the examination.

7 Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL http://www.usq.edu.au/corporateservices/calendar/part5.htm or in the current USQ Handbook.

ASSESSMENT NOTES

1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.

2 Students must retain a copy of each item submitted for assessment. This must be produced within five days if required by the Examiner.

3 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.

4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media. Assignments in this course may require the submission of additional material on computer disk, as specified in the assignment requirements.

5 The Faculty will NOT accept submission of assignments by facsimile.

6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.

7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.

8 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 one of the temporary grades: IM (Incomplete - Make up), IS (Incomplete - Supplementary Examination) or ISM (Incomplete -Supplementary Examination and Make up). A temporary 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); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).

OTHER REQUIREMENTS

1. Students will require access to e-mail and internet access to USQConnect for this course.