Description: Robotics and Machine Vision

<table>
<thead>
<tr>
<th>Subject</th>
<th>Cat-nbr</th>
<th>Class</th>
<th>Term</th>
<th>Mode</th>
<th>Units</th>
<th>Campus</th>
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<tr>
<td>ENG</td>
<td>4406</td>
<td>34561</td>
<td>2, 2004</td>
<td>ONC</td>
<td>1.00</td>
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Academic group: FOENS
Academic org: FOES02
Student contribution band: 2
ASCED code: 030799

STAFFING
Examiner: John Billingsley
Moderator: Paul Wen

OTHER-REQUISITES
Recommended Pre-requisite: ELE2103

SYNOPSIS
Robotics and machine vision are specialised aspects of mechatronics, the fusion of digital control with electronics and mechanisms to realise an application of value to manufacturing and other industries. Mechatronic control system design requires the ability to embrace nonlinearities in both the system and the controller. Kinematic methods are taught for the design and analysis of robot manipulators and similar mechanisms. Aspects of control theory cover modelling and synthesis of nonlinear controllers such as the saturating drives demanded for real life actuator systems. The vision syllabus ranges over the variety of image acquisition systems now available, leading on to methods of image analysis. Image filtering and edge detection are compared with more pragmatic methods and examples are taken from research outcomes such as the vision guidance system now being implemented on agricultural tractors.

OBJECTIVES
On completion of this course, students should be able to:

1. kinematics and positional control of articulated manipulators;
2. design techniques for controlling mechanical systems;
3. basics of machine vision concepts applicable to robotics.
### TOPICS

<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>1. Kinematics and inverse kinematics for robots</td>
<td>35.00</td>
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<td>2. Control for robots</td>
<td>25.00</td>
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<tr>
<td>3. Robot programming principles</td>
<td>5.00</td>
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<tr>
<td>4. Introduction to sensing for robots</td>
<td>10.00</td>
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<tr>
<td>5. Machine vision for robots</td>
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</table>

**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).

*ENG4406 Robotics and Machine Vision External Study Package, USQ Publication,*

MATLAB Student Edition, Version 5 or later.

Tran-Cong, T. 1998, *Dynamics for Engineering Students, USQ Publication,*

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

<table>
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<tr>
<th>Description</th>
<th>Marks out of</th>
<th>Wtg(%)</th>
<th>Due date</th>
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<td>ASSIGNMENT 1</td>
<td>200.00</td>
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<td>ASSIGNMENT 2</td>
<td>200.00</td>
<td>20.00</td>
<td>22 Oct 2004</td>
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<td>60.00</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 gained by the student for the assignment will apply for each working day late.

4. Requirements for student to be awarded a passing grade in the course:
   (i) 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 satisfactorily completing all summative assessment items (the examination and assignments), as stated in 2 above. (ii) Students who do not qualify for a Passing grade may, at the discretion of the Examiner, be assigned additional work to demonstrate to the Examiner that they have achieved the required standard. It is expected that such students will have gained at least 45% of the total 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 In this course students may submit assignments electronically in the format 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.

9 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).