Description: Control and Instrumentation

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<th>Subject</th>
<th>Cat-nbr</th>
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<th>Term</th>
<th>Mode</th>
<th>Units</th>
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Academic group: FOENS
Academic org: FOES04
Student contribution band: 2
ASCED code: 031399

STAFFING
Examiner: Gordon Hampson
Moderator: Paul Wen

REQUISITES
Pre-requisite: MAT1100

SYNOPSIS
This course covers the elements of classical control. A good grounding in the understanding of the dynamic behaviour of systems is followed by a study of the elements that make up some control systems. Standard techniques for modifying the behaviour of control systems are examined. Particular studies of real world control systems are used to bring together the topics previously covered.

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

1. categorise and analyse the behaviour of a dynamic system;
2. describe the characteristics of common control system components;
3. interpret controller characteristics;
4. measure overall control system characteristics;
5. predict overall control system behaviour from the characteristics of the components which comprise the system;
6. analyse and trouble shoot control loop faults;
7. evaluate and tune a control system loop controller.
8. evaluate and tune a control system loop controller.

TOPICS

<table>
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<tr>
<th>Description</th>
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<tbody>
<tr>
<td>1. Introduction to control systems: open loop systems, closed loop systems, types of system behaviour, types of control systems.</td>
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2. Behaviour of simple systems: zero, first and second order, higher order, process systems, inputs other than step inputs, frequency response. 13.00

3. Feedback control: block diagrams, feedback options, transfer functions, steady state values. 13.00

4. Some control system hardware: transducers, amplifiers, actuators, motor speed control, DC servo system. 13.00

5. Frequency response of control systems: measurements, Bode plots, stability criteria, Nyquist diagrams. 20.00

6. Signal processing and transmission: amplifiers, noise, external interference, noise reduction techniques. 2.00

7. The compensation of system performance: effects of gain, effects of rate feedback, compensation techniques, controllers, controller settings 20.00

8. Further control system hardware: hydraulic control, pneumatic control systems and controllers, instrument servo mechanisms, digital control systems 12.00

9. Overview: the complete system, introduction to advanced control topics 2.00

**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).

A cheap protractor, scale ruler, dividers and drawing compass.
A pad of A4; 4 cycle, semi-log graph paper.

**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.

In this course, the study book serves as the text book and main source of all assessable information - sufficient for students to meet all of the course objectives to a high level of achievement without recourse to the recommended reference materials.

Bissell, C C 1994, *Control Engineering*, 2nd edn, Chapman and Hall,


STUDENT WORKLOAD REQUIREMENTS

<table>
<thead>
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<th>ACTIVITY</th>
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<td>Examinations</td>
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ASSESSMENT DETAILS

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NOTES

1. The 3 hour examination is in two parts. Part A requires an Examination Answer Sheet. Part B requires an Answer Booklet. Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

1 Attendance requirements:
   There are no attendance requirements for this course. However, it is the students’ responsibility 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:
   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:
   The examination in this course is a combined examination. Part A is a closed
   examination of 1.5 hours duration and 400 marks have been allocated for this part. Part
   B is a restricted examination of 1.5 hours duration and 250 marks have been allocated
   for this part. In a restricted examination, candidates are allowed access to specific
   materials during the examination. The only materials that candidates may use in the
   restricted examination for this course are: writing materials (non-electronic and free
   from material which could give the student an unfair advantage in the examination);
   only hand held battery operated programmable calculators are permitted. Students must
   note the make and model of the calculator used on the front of the Answer Book or
   Examination Paper where applicable. This may be subject to checking by the supervisor.
   In a closed examination, candidates are allowed to bring only writing and drawing
   instruments into the examination. This examination is confidential and is printed on
   blue paper. Students may NOT retain the blue examination paper. All materials supplied
   MUST be returned, whether used or not.

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
   despatched to USQ within 24 hours 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.

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).

OTHER REQUIREMENTS
1 Students will require access to computer facilities to complete CMA assignment tests.