Stellenbosch University Faculty of Engineering

Module Framework

This document should be read with the following documents: Stellenbosch University Calendar Parts 1 and 11, Faculty of Engineering Assessment Rules[1], Faculty of Engineering General Stipulations for Undergraduate Modules[1]

Module: 23965 **Control Systems 344** 2014	Lecturer(s): **Prof WH Steyn** **Room: E402, whsteyn@sun.ac.za**	Date: 22/07/2014 Programme Coordinator:

1. Assessment Details

- Major assessment dates and venues are provided at firga.sun.ac.za and mymaties.com
- Note that awarding a pass mark is subject to meeting each the ECSA Exit Level Outcomes assessed in this module, as stated in Faculty of Engineering's Assessment Rules

Calculation of final marks (according to formulas in the Faculty of Engineering's Assessment Rules):

Assessment Method: Flexible: w_{SM} = 10%; w_{A1} = 40%; w_{A2} = 50%

SM=average(Tut tests), A1=test during test week, A2=test in first examination period

Note that both A1 and A2 are compulsory.

2. Module Objectives

Aim: Mastering the basic aspects of electromagnetic waves on guided structures and in free space.

A student who has successfully completed this module can:

- Do state space modelling of linear systems.
- Design and understand observers in state space form, with and without compensation for noise effects.
- Design controllers and observers for regulator and servo systems with partially measurable state variables.
- Implement continuous controllers in a computer with discrete equivalent methods.
- Use Z-transforms to discretise continuous plants and design discrete controllers using root locus method.

3. Module Content and Schedule

Prescribed textbook(s):
Gopal, *Digital Control and State Variable Methods*, Third Edition, McGraw Hill
The ebook is now available for purchase at:
https://create.mcgraw-hill.com/shop/#/catalog/details/?isbn=9781121884090
Supplementary Material: Additional notes will be provided where necessary

Week	Topic	Contact Session/Assignments
1	Revision/Introduction to SS systems – Gopal 5.3	-
2	SS Modelling/Transfer function conversion – Gopal 5.4, 5.5	Tutorial 1
3	Solution of SS equations/Controllability/Observability – Gopal 5.6 - 5.8	Tutorial 2
4	Pole placement design – Gopal 7.1 - 7.4	Tutorial 3
5	State observer design/Separation principle – Gopal 7.5, 7.6	Tutorial 4
6	Servo design/Reference input – Gopal 7.7	Practical 1
	Test Week and Break	
7	Introduction to discrete systems – Gopal 2.1 – 2.5	Test Discussion
8	Z-transform/Discrete transfer function/Stability – Gopal 2.6 – 2.10	Tutorial 5
9	Sampled systems/Discrete equivalents – Gopal 3.1 – 3.5, 2.11, 2.12	Tutorial 6
10	Discrete design specifications – Gopal 4.1, 4.2	Tutorial 7
11	Discrete root locus design – Gopal 4.4	Tutorial 8
12	Discrete root locus design – Gopal 4.5	Practical 2

[1] Available on SUNLearn for modules offered by Faculty of Engineering, in the block titled "General Programme Information" on the left-hand side

4. ECSA Knowledge Area Credits

Mathematical Science	Basic Science	Engineering Science	Design and Synthesis	Complementary Studies
0	0	12	3	0

Engineering Science:
Content: Science of control systems from an engineering perspective.
Assessment: Assessed in tests, tutorials and practicals
Design and Synthesis:
Content: Practicals and tutorials contain design assignments
Assessment: Practical reports and tutorial designs are assessed individually

5. ECSA Exit Level Outcomes

This module is not used to assess any ECSA Exit level Outcomes.

6. Other Module Specific Information

1. All classes, practicals and tutorials are **compulsory**. An **INCOMPLETE** will be registered for failure to attend. This rule also applies to repeating students.
2. Each tutorial session may consist of 2 or 3 parts: homework problem-solving (by demi students), tutorial problem-solving (independently) and a possible class test.
3. Handing in of practical results is compulsory – non-compliance will be treated as an INCOMPLETE. Tasks must be handed in individually as separate reports and may be neatly written by hand.
4. TWO OR MORE STUDENTS MAY NEVER HAND IN THE SAME REPORT OR TASK. Even group work requires individual reports.

TESTS AND EXAMINATIONS

1. Students will be required to write a number of unannounced tests during the semester. These tests will also count towards the final mark.
2. Prescribed pocket calculators may be used in all main tests. **No electronically stored information may be brought into test venues**. A single A4 original handwritten (not copied or typed) note page may be consulted during announced tests.

TUTORIAL/PRACTICAL/TEST DATES

1.	21/07/14	-	
2.	28/07/14	Tutorial 1	(SS modelling)
3.	04/08/14	Tutorial 2	(Realization)
4.	11/08/14	Tutorial 3	(Solution of SS equation and introduction to SS feedback control)
5.	18/08/14	Tutorial 4	(Pole placement and controllability/observability)
6.	25/08/14	Practical 1	(SS feedback control design using MATLAB)
7.	05/09/14	Test 1 CS344	11h00
8.	06/09/14	Start of September holiday	
9.	15/09/14	Test feedback	(Test discussion)
10.	22/09/14	Tutorial 5	(Introduction to discrete systems)
11.	29/09/14	Tutorial 6	(Z-transform and discrete transfer functions)
12.	06/10/14	Tutorial 7	(Sampled systems and discrete equivalents)
13.	13/10/14	Tutorial 8	(Discrete root locus design)
14.	20/10/14	Practical 2	(Discrete design on tutor)
15.	28/10/14	Start of November Examination Period	
16.	30/10/14	Test 2 CS344	14h00
17.	24/11/14	Test 3 CS344	14h00