# STELLENBOSCH UNIVERSITY
# FACULTY OF ENGINEERING
# **STUDY GUIDE**

## 1. MODULE DATA

| MODULE CODE | MODULE | | | | CALENDAR YEAR | SAQA CREDITS | WORKLOAD h/week |
|---|---|---|---|---|---|---|---|
| 46779 214 | Systems and Signals 214 (A & E) | | | | 2014 | 15 | 12 hr/week |
| YEAR/SEMESTER | LECTURING LOAD PER WEEK | | HOME DEPARTEMENT | | | | |
| 2 – 1 | 3 l, 1.5 p, 1.5 t, 0 s | | Electrical and Electronic Engineering | | | | |
| LECTURER(S) | EMAIL | | OFFICE NUMBER(S) | | TELEPHONE NUMBER(S) | | |
| Professor H C Reader | hcreader@sun.ac.za | | E408 | | 021 8084119 | | |
| CLASSIFICATION OF KNOWLEDGE AREAS | Mathematics | Basic Science | Engineering Science | Design & Synthesis | Computing & IT | Complementary Studies | |
| | 0 | 0 | 15 | 0 | 0 | 0 | |

| ECSA EXIT LEVEL OUTCOMES (marked with x only if the module has ECSA exit level outcomes) | Problem solving | Application of scientific and engineering knowledge | Engineering design and synthesis | Investigations, experiments and data analysis | Engineering methods, skills, tools and IT | Professional & technical communication | Impact of engineering activity | Individual, team and multidisciplinary work | Independent learning ability | Engineering Professionalism |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

| PREREQUISITE MODULES | PREREQUISITE PASS (P ≥ 50) | PREREQUISITE (40≤P<50 or K ≥ 40) | COREQUISITE |
|---|---|---|---|
| | | Electro Technique 143 | |

| ASSESSMENT DETAILS<br>See Year Book Parts 1 and 11for regulations. | METHOD | FINAL MARK FORMULA |
|---|---|---|
| | Flexible Assessment according to the Faculty Standard Assessment policy<br><br>T1 -Test in Test Week<br>A - Additional class tests, Tuts, Pracs<br>T2 – Test in 1st Exam period<br>T3 – Test in 2nd Exam period | If all pass pre-requisites of the module are met, the PP Is calculated as follows:<br><br>**PP = 0.4T1 + 0.1A + 0.5T2**<br><br>T3 may be taken and used to replace T1 or T2 under the following conditions:<br>1. Approved absence of T1 or T2; or<br>2. 40 <= PP < 50 after completion of T1 and T2,<br>but only a final PP<=50 may be awarded. A subminimum of 40% in T2 or T3 is required to pass. |

Approved by:

_____ _____

Chairperson/Programme Co-ordinator

# 2. SPECIFIC OUTCOMES AND ASSESSMENT CRITERIA

## 2.1. ECSA EXIT LEVEL OUTCOMES ASSESSED IN THIS MODULE

| Outcome | How is Exit Level Outcome Assessed?<br><br>Assessment criteria and assessment methods. | What is satisfactory performance?<br><br>Using the knowledge gained in this module, a student can do the following at the level of a graduate engineer. |
|---|---|---|
| **1. Problem solving*:*** Demonstrate competence to identify, assess, formulate and solve *convergent* and *divergent* engineering problems creatively and innovatively. | N/A | N/A |
| **2. Application of scientific and engineering knowledge*:*** Demonstrate competence to apply knowledge of mathematics, basic science and engineering sciences from first principles to solve engineering problems. | N/A | N/A |
| **3. Engineering Design*:*** Demonstrate competence to perform creative, *procedural* and *non-procedural* design and synthesis of components, systems, engineering works, products or processes. | N/A | N/A |
| **4. Investigations, experiments and data analysis*:*** Demonstrate competence to design and conduct investigations and experiments. | N/A | N/A |
| **5. Engineering methods, skills and tools, including Information Technology*:*** Demonstrate competence to use appropriate engineering methods, *skills* and tools, including those based on information technology. | N/A | N/A |
| **6: Professional and technical communication*:*** Demonstrate competence to communicate effectively, both orally and in writing, with engineering audiences and the community at large. | N/A | N/A |
| **7. Impact of Engineering activity*:*** Demonstrate *critical awareness* of the impact of engineering activity on the social, industrial and physical environment. | N/A | N/A |

| | | |
|---|---|---|
| **8. Individual, team and multi-disciplinary working*:*** Demonstrate competence to work effectively as an individual, in teams and in multi-disciplinary environments | N/A | N/A |
| **9. Independent learning ability*:*** Demonstrate competence to engage in independent learning through well-developed learning skills. | N/A | N/A |
| **10. Engineering Professionalism*:*** Demonstrate *critical awareness* of the need to act professionally and ethically and to exercise judgment and take responsibility within own limits of competence. | N/A | N/A |

# 2.2 CAPABILITIES

These are the aims of the module.

**A student who has successfully completed this module can:**

- Understand and use techniques of circuit analysis; Analyse and design operational amplifier circuits; Analyse first- and second order circuits.
- Do sinusoidal steady state analysis and power calculations; Analyse balanced three-phase circuits.

| **PERFORMANCES**<br>Students are required to demonstrate competence and understanding in the following areas More than one of these performances can be expected in a single exam or test question. | **TYPICAL ASSESSMENT CRITERIA**<br>The examiners will give credit if the student successfully performs the following tasks. | **RANGE STATEMENTS**<br>These statements further describe the nature and complexity of the required performance. |
|---|---|---|
| • Determine the DC current and voltage of a given circuit. | • The circuit is transformed to the correct form if necessary.<br>• Correct node-voltage or mesh-current equations are determined.<br>• The current and voltage is correctly solved from the equations. | To achieve this, the learner should:<br>• Be able to apply Ohm and Kirchhoff current and voltage laws.<br>• Be able to determine the Thevenin and Norton equivalent circuits from the given linear configuration.<br>• Understand inductor and capacitor principles. |
| • Determine the current and voltage with time in a circuit. It can also be done with a switch that switches immediately. | • The circuit is transformed to the correct form if necessary.<br>• The initial conditions are determined.<br>• The correct circuit equations are established.<br>• The current and voltage are correctly solved from the equations. | To achieve this, the learner should:<br>• Be able to apply Ohm and Kirchhoff current and voltage laws.<br>• Be able to determine the Thevenin and Norton equivalent circuits from the given linear configuration.<br>• Understand inductor, mutual inductance and capacitor principles.<br>• Be able to use first and second order differential equations. |
| • Design/analyse simple operational amplifier circuits. Assume that the operational amplifier is ideal. | • The properties of the ideal operational amplifier are correctly applied on the given configuration.<br>• The equations that describe the properties of the circuit are correctly established and solved. | To achieve this, the learner should:<br>• Understand the properties of ideal operational amplifiers. |
| • Analyse steady state circuits and do power calculations. | • The circuit is transformed to the correct form (if necessary).<br>• The correct circuit equations are established.<br>• The current, voltage and power are correctly solved from the equations. | To achieve this, the learner should:<br>• Understand basic circuit and power principles. |
| • Analyse a balanced three-phase circuit. | • The one-phase circuit is drawn correctly.<br>• V Basic circuit analysis is done correctly. | To achieve this, the learner should:<br>• Understand the principles of three-phase circuits.<br>• Have a good understanding op complex power. |

# 3. MODULE CONTENTS AND PRESENTATION PLAN

RESOURCES:
Prescribed textbook:
J.W. Nilsson and S.A. Reidel; *Electric Circuits*, ninth edition, Prentice Hall, 2007.

Other resources:
None

| WEEK | DATE | CHAP. | DESCRIPTION | TUTORIAL/ PRACTICAL |
|---|---|---|---|---|
| 1 | 03/02 – 07/02 | 1 – 3 | Basic principles of circuit analysis | Tutorial 1 |
| 2 | 10/02 – 14/02 | 4 | Circuit analysis techniques | Practical 1 |
| 3 | 17/02 – 21/02 | 4 – 5 | Circuit analysis techniques / Operational Amplifiers | Tutorial 2 |
| 4 | 24/02 – 28/02 | 5 – 6 | Operational Amplifiers / Capacitance and inductance | Practical 2 |
| 5 | 03/03 – 07/03 | 6 – 7 | Capacitance and inductance / First order RL and RC circuits | Tutorial 3 |
| 6 | 10/03 – 14/03 | 6 – 7 | First order RL and RC circuits. **First term ends.** | Tutorial 4 |
| 7 | 17/03 – 21/03 | 7 – 8 | **Second term starts**. Second order RLC circuits. (**Friday public holiday**) | Tutorial 5 |
| | 24/03 – 28/03 | **TEST WEEK** | | |
| | 29/03 – 6/04 | **VACATION** | | |
| 8 | 07/04 – 11/03 | 8 | Second order RLC circuits | Tutorial 6 |
| 9 | 14/04 – 18/04 | 8 | Second order RLC circuits. Friday timetable on Wednesday. (**Good Friday 18 April**) | Practical 3 |
| 10 | 21/04 – 25/04 | 9 | Sinusoidal steady state analysis. Monday timetable on Tuesday. (**Easter Monday 21 April**) | Tutorial 7 |
| 11 | 28/04 – 02/05 | 9 – 10 | Sinusoidal steady state analysis / Power calculations. (**Monday and Thursday public holiday**) | |
| 12 | 05/05 – 9/05 | 10 – 11 | Power calculations / Balanced three phase circuits | Practical 4 |
| 13 | 12/05 – 16/05 | 11 | Balanced three phase circuits. **Second term ends.** | Tutorial 8 |

PS: The lecturing plan above may be changed by the lecturer if necessary.

# 4. PRACTICALS AND TUTORIALS

- Tutorials and practicals are compulsory. **Attendance forms a part of your semester mark**. If a student has an incomplete in more than two tutorials or practicals, access to writing the examination will be forfeited.
- To complete a tutorial, the student must show, at the end of the tutorial period, that the task was completed satisfactorily.
- To complete a practical the student must show all required preparation work for the practical within the first 15 minutes of the practical period, as well as demonstrate the working circuit by the end of the period. No more than three people may work in a group during practicals.
- If a tutorial or practical is missed due to a valid reason (as stipulated by the university yearbook), the student has one week after his/her return to campus to present proof of such (such as a doctor's note) to the lecturer.

# 5. TESTS AND EXAMINATIONS

- Pocket calculators may be used in tests and examinations. No written material or electronically stored information may be brought into test or examination rooms or referred to by any means, except in the case of open book tests or exams.
- A final mark of less than 50 will be awarded if a student fails to meet any ECSA exit level outcome specified for this module.

# 6. GENERAL INFORMATION AND STUDY TIPS

- If you want to speak to the lecturer, please make an appointment by email. As engineer you are required to be able to communicate in writing in a professional manner, and therefore any informal/unprofessional emails will be ignored (no SMS-language!).
- A class list will regularly be published on the web page of the module indicating the current number of incomplete tutorials/practicals. Please check this regularly and inform the lecturer of any errors/omissions.

BE VIGILANT IN LECTURES AND ASK THE LECTURER FOR HELP IF YOU DO NOT UNDERSTAND SOMETHING!