(*faculty stamp*)



**COURSE DESCRIPTION**

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|---|---|
| **1. Course title:** INTRODUCTION TO ELECTRONICS | **2. Course code** ItE |
| **3. Validity of course description:** 2012/2013 | |
| **4. Level of studies:** BSc programme | |
| **5. Mode of studies:** intramural studies | |
| **6. Field of study**: CONTROL, ELECTRONIC AND INFORMATION ENGINEERING | (FACULTY SYMBOL) AEI |
| **7. Profile of studies:** general academic | |
| **8. Programme:** | |
| **9. Semester:** 3, 4 | |
| **10. Faculty teaching the course:** FACULTY OF AUTOMATIC CONTROL, ELECTRONICS AND COMPUTER SCIENCE, Institute of Electronics | |
| **11. Course instructor**: Zdzisław Filus, PhD, DSc, professor of SUT | |
| **12. Course classification:** common subjects | |
| **13. Course status:** compulsory | |
| **14. Language of instruction:** English | |
| **15. Pre-requisite qualifications:** Course attendants have to possess basic knowledge in calculus, algebra, physics and circuit theory. | |
| **16. Course objectives:** The objective of the course is to provide basic understanding of the operating principles of semiconductor devices and an introduction to the theory and operation of electronic circuits. | |
| **17. Description of learning outcomes:** | |

| Nr | Learning outcomes description | Method of assessment | Teaching methods | Learning outcomes reference code |
|---|---|---|---|---|
| 1. | The student will know principles of operation, parameters and characteristics of basic semiconductor devices | Written test | Lecture based on computer presentations | K_W6 |
| 2. | The student will know structures and principles of operation of basic analog electronic circuits | Written test<br>Written examination | Lecture based on computer presentations | K_W6 |
| 3. | The student will know simple methods of description and analysis of analog, linear and nonlinear, electronic circuits | Written test<br>Written examination | Lecture based on computer presentations | K_W8 |
| 4. | The student will be able to use the learnt methods and mathematical models in the DC analysis of elementary, linear and nonlinear, analog electronic circuits | Written test<br>Written examination | Class | K_U7 |
| 5. | The student will be able to use the learnt methods and small-signal mathematical models for the determination of characteristic parameters of simple linear electronic circuits | Written test<br>Written examination | Class | K_U7 |

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|---|---|---|---|---|
| 6. | The student will be able to use properly chosen methods and equipment for measurement of parameters and characteristics of electronic components and circuits | Laboratory exercise<br>Written test | Laboratory | K_U18 |
| 7. | The student will be able to elaborate a report including a discussion on the results of a laboratory exercise | Written report | Laboratory | K_U3<br>K_U18 |
| 8. | The student will be able to work in a team and to take responsibility for a jointly realized task | Laboratory exercise<br>Written report | Laboratory | K_K3 |

**18. Teaching modes and hours**

**Lecture / BA /MA Seminar / Class / Project / Laboratory**

60/–/30/–/30

**19. Syllabus description:**

**Lecture**

Introduction: definitions and basic features of analog and digital signals and circuits. Resistors, capacitors, inductors and transformers. Logarithmic scale and Bode plots. Basic RC circuits. Intrinsic and extrinsic semiconductors. P-N junction: charge density, electric field and voltage distribution, contact potential, capacitance of the junction, V-I characteristics, switching characteristics. Various types of diodes: Zener and avalanche effects, varicaps, Schottky diodes. Bipolar transistors: principle of operation, basic characteristics and parameters, Ebers-Moll model, linear piecewise models, small-signal equivalent circuits, switching characteristics, biasing circuits, basic amplifiers: CE, CB and CC, current sources, current mirror. Field-effect transistors: operation of JFETs and MOSFETs, voltage-to-current characteristics, biasing circuits, basic amplifiers (CS, CG, CD), current sources, analog switches, NMOS and CMOS gates. Optoelectronic devices: photoresistor, photodiode, light emitting diode, optocouplers, displays. Simplified theory of feedback: types of feedback systems, influence of negative feedback on gain, input and output impedances, bandwidth, noise reduction, stability, gain and phase margins. Power amplifiers: class A, B, C, D amplifiers, principle of operation, efficiency. Differential amplifier: large and small-signal analysis. Operational amplifiers: ideal and non-ideal amplifier, basic applications. Integrators and differentiators. Analogue comparators. Sine wave oscillators. Square wave and ramp oscillators. Rectifier systems. Regulated power supplies: IC voltage regulators, switching regulators. Sample & hold circuits. Analogue-to-digital and digital-to-analogue converters: basic methods of conversion and their comparison.

**Class**

Frequency response of simple RC networks. Diode applications. Simple linear voltage regulators. Quiescent point of simple transistor amplifiers and its thermal stabilisation. Small-signal analysis of amplifiers: equivalent circuit. Ideal operational amplifier and its basic applications. Voltage regulators. Sine wave oscillators. Square wave oscillators. Non-linear circuits with operational amplifiers.

**Laboratory**

1. Introduction to measurement instruments
2. Semiconductor diodes
3. Bipolar transistors
4. Unipolar transistors
5. Optoelectronic devices
6. Rectifier circuits
7. Linear voltage regulators
8. Sine wave oscillators
9. Applications of operational amplifiers
10. Square wave and ramp oscillators
11. Power amplifiers

**20. Examination:** The examination consists of two written parts: practical problems and theory.

**21. Primary sources:**

Teaching materials available on the internet didactic platform for registered students
Horowitz P., Hill W., The Art of Electronics. Cambridge University Press, 2001
Tietze U., Schenk Ch.: Electronic circuits. Springer-Verlag Berlin Heidelberg, 2008
Cooke M.J.: Semiconductor Devices. Prentice-Hall, 1990
Savant C.J., Roden M.S., Carpenter G.L.: Electronic Design: Circuits and Systems. Benjamin/Cummings, 1991

**22. Secondary sources:**

Tietze U. Schenk Ch.: Układy półprzewodnikowe. WNT, Warszawa 2009
Filipkowski A.: Układy elektroniczne analogowe i cyfrowe. WNT, Warszawa 2006
Chwaleba A., Moeschke B., Płoszajski G.: Elektronika. WSiP, Warszawa 2008
Ciążyński W. E.: Elektronika analogowa w zadaniach, t.1, 2, 3. 4. Wydawnictwo Politechniki Śląskiej, Gliwice 2009-2010
Laboratorium elektroniki I: Elementy półprzewodnikowe i układy podstawowe. Praca zbiorowa pod red. Krzysztofa Zioło; Wydawnictwo Politechniki Śląskiej, skrypt nr 2322, Gliwice 2003
Laboratorium elektroniki II: Podstawowe układy analogowe, impulsowe i cyfrowe. Praca zbiorowa pod red. Krzysztofa Zioło; Wydawnictwo Politechniki Śląskiej, skrypt nr 2323, Gliwice 2003

**23. Total workload required to achieve learning outcomes**

| Lp. | Teaching mode : | Contact hours / Student workload hours |
|---|---|---|
| 1 | Lecture | 60/25 |
| 2 | Classes | 30/30 |
| 3 | Laboratory | 30/50 |
| 4 | Project | / |
| 5 | BA/ MA Seminar | / |
| 6 | Other | 5/30 |
| | Total number of hours | 125/135 |

**24. Total hours:**260

**25. Number of ECTS credits:** 9

**26. Number of ECTS credits allocated for contact hours: 4**

**27. Number of ECTS credits allocated for in-practice hours (laboratory classes, projects): 3**

**26. Comments:**

Approved:

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*(date, Instructor's signature)* (*date , the Director of the Faculty Unit signature)*