AEEE239 - Electronics II

Course Title	Electronics II				
Course Code	AEEE239				
Course Type	Compulsory				
Level	BSc (Level 1)				
Year / Semester	2/2				
Teacher's Name	Prof Christos Themistos				
ECTS	5	Lectures / week		Laboratories/week	
Course Purpose	The aim of the course is to familiarize the students with the concepts and the principles of operation of operational amplifiers (op-amps), in order to identify and implement their basic arrangements in open- and closed loop configurations and to design op-amp based devices, such as active filters, signal generators and analogue to digital and digital to analogue converters.				
Learning Outcomes	By the end of the course, students must be able to: 1. Define the input and output characteristics of the operational amplifier (op-amp) and identify the basic op-amp parameters. Estimate the 741 Op-amp Voltage gain, input-output impedance, input offset, slew rate, common mode rejection ratio. Review the negative feedback principle and appraise the effect of Negative feedback on the voltage gain and frequency response of the op-amp. 2. Derive the voltage gain of op-amp applications, such as the non-inverting, inverting, summing, integrator and differentiator amplifier. Estimate the voltage gain of the various op-amp applications and select the appropriate components to achieve the desired signal conditioning of the input signals. Design Analogue to Digital Converter and Digital to Analogue converters, using op-amps. 3. Identify the open- and closed-loop gain and phase response parameters of the op-amp, such as cut-off frequency, bandwidth, gain-bandwidth product. Deduce the gain and phase response of a first-order low pass filter. Construct the overall gain and phase frequency response of cascaded op-amps. 4. Classify the frequency responses of low-, high- and band-pass filters. Deduce the gain and phase response of first order and second order op-amp based active filters and select appropriate resistor and capacitor values to construct the required gain and phase response. Integrate first and second order active filters in the design of higher order active filters such as Butterworth, Chebychev and Bessel filters. Use the relevant table and propose suitable component values for the design of higher order active filters. 5. Describe the principle of operation of oscillators. Examine the operation of voltage controlled (VCO) oscillators and calculate the condition for oscillation. Explain the operation of the 555 timer and distinguish the				

	monostable and astable mode of operation. Perform analogue to digital conversion and sampling using oscillators.		
Prerequisites	AEEE238	Corequisites	None
Course Content	**Operational Amplifiers:** The differential Amplifier, Op-Amp characteristics and parameters. Voltage gain, input-output impedance, input offset, slew rate, common mode rejection ratio, Effects of Negative feedback. **Op-Amp Applications:** Non-inverting, inverting and summing Amplifiers. Differentiator and integrator. Comparators and Analogue to Digital Flash Converter. Digital to analogue converter using summing amplifiers. **Frequency Response:** Open- and closed loop configuration gain and phase response, cut-off frequency, bandwidth, gain-bandwidth product. **Active Filters**: Basics of low pass, high pass and band pass, first and second order active filters. Higher-order Active Filter design (Butterworth, Chebychev and Bessel). **Oscillators:** Principle of operation of oscillators. Voltage controlled (VCO) oscillators. Operation and applications of the 555 timer in monostable and astable mode. Phase lock loops (PLL). Analogue to digital conversion and Sampling. **Laboratory work:** Individual and small group experiments performed with the use of Electronic boards, components, measuring instruments and simulation packages. Experiments include the design, construction on Electronic boards and analysis of the circuits and devices taught in theory. Testing is performed using signal measuring equipment such as digital multimeters, oscilloscopes and spectrum analysers. The performance of the designed circuits is also simulated and the results are evaluated and compared with the experimental analysis.		
Teaching Methodology	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the e-learning platform or the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Furthermore, design projects may be assigned to the students, where literature search is encouraged to identify a specific problem related to some issue, gather relevant scientific information about how others have		

	addressed the problem, implement to implement the design and report the results in written or orally. Laboratory experiments are carried out in small groups and lab reports are required two weeks after the laboratory class resulting in a cumulative mark.
Bibliography	**(i) <u>Textbooks:</u>** • T.L. Floyd D.L Buchla, ***Electronics Fundamentals: Circuits, Devices, and Applications,*** Pearson, 8th Ed., 2009 **(j) <u>References:</u>** • J. Huijsing**, *Operational Amplifiers: Theory and Design*,** Springer**,** 3rd Ed., 2017 • R. Boylestad and L. Nashelsky***, Electronic Devices and Circuit Theory***, 11th Ed. Prentice Hall, 2012
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 40% and 60%, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as mid-term written exam, quizzes, assignments, design projects and laboratory experiments. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted continuous assessment of the course is shown below: • Assignments 10% • Design Project 20% • Mid-Term written exams 30% • Laboratory Work 40% Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constrains and revision timetable. The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	**English**