Date:	Examination No.:	Version:2021-2022	Start:25/1/2022
Module Name - Code	Analog IC Design -21200		
Module Language:	English		
Responsible:	Dr. Muhammed A Ibrahim		
Lecture (s):	None		
College:	College of Engineering – Salahaddin University-Erbil		
Duration:	15 weeks – 1 semester		
Course outcomes:	At the end of the semester, students will be able to - carry out research and development in the area of analog signal IC design. - analysis and design of operational amplifiers (OPAMPs) based structures in terms of input and output resistances, their gain and their frequency response - analysis and design some op-amp based special circuits - carry out sufficient information about feedback as it applies to op-amp amplifiers - analysis and design of active filters - design of oscillator circuit - carry out applications of a special IC which is called "Triple 5" or "555".		
Course Content:	**A) Theoretical Part** ➢ Integrated Circuits. General Introduction, Basic principles. ▪ Operational amplifiers. Introduction to operational amplifier, Block diagram of a typical Op-Amp, ▪ Ideal vs. Practical opamps: opamp parameters (Voltage and current offsets, CMRR, Slew Rate), opamp frerequency response, opamp analysis ▪ Applications of Op-Amp: Finite Gain amplifier, Unity gain amplifier, Inverting type of finite gain amplifier, Non-inverting type of finite gain amplifier, Summing point amplifier, Integrator, Differentiator, Voltage Follower, Difference Amplifier, Adder-Subtractor, Voltage Regulators (Fixed voltage regulators, Adjustable voltage regulators, Switching Regulators), Negative Resistance Converter, Gyrator, Generalized Impedance Converter. ➢ Feedback: Types, properties, Basic feedback topologies. ➢ Active filters: Filters and filter types, Transfer functions, Poles, zeros, quality factor & pole frequency, Second-order filters, Higher-order filters, Filter Approximations, Gain & phase distortions ➢ Oscillators: Oscillator Principles, The Wien-Bridge Oscillator, Distortion Reduction in a Linear Oscillator, Phase-Shift Oscillator, Quadrature Oscillator, LC Oscillators (Haretly Oscillator, Colpitts Oscillator), Crystal Oscillator ➢ Specialized IC applications: 555 Timer: Pin configuration, Block diagram, application of 555 as Monostable and Astable Multivibrator. ➢ Special-Purpose Op-Amp Circuits: Instrumentation Amplifiers, Isolation Amplifiers, Operational Transconductance Amplifiers (OTAs), Log and Antilog Amplifiers, Converters and Other Op-Amp Circuits. **B) Practical Part** • Experiment No.1 -Push Pull Amplifier		

	- Experiment No.2 -Tuned Amplifier
	 - Experiment No.3 -Differential Amplifier using BJT
	 - Experiment No.4
	    ○ Opamp basics (Inverting, Non-Inverting, Voltage Follower)
	    ○ Opamp basics (Measurement of input & output Impedances)
	 - Experiment No.5
	    ○ Opamp basics (Common Mode Rejection Ratio measurement)
	    ○ Opamp circuits (Adder & differential amplifier)
	 - Experiment No.6 -Special Opamp circuits (Log and Antilog Amplifiers)
	 - Experiment No.7
	    ○ Active High Pass & Low Pass Filters
	    ○ Oscillators (Wien bridge oscillator & Square Wave Generator)
	 - Experiment No.8 -Transistor as a switch
	 - Experiment No.9 -Astable Multivibrator
	 - Experiment No.10 -Bistable Multivibrator
	 - Experiment No.11 -Monostable Multivibrator
	 - Experiment No.12 -Voltage Regulator.

Literature:	- Thomas L. Floyd, Electronic Devices, 9th Edn, Prentice-Hall, 2012 - Robert L. Boylestad, Louis Nashelsky, Electronic devices and circuit theory, 11th Edn, Pearson, 2013 - Jeffrey Beasley, Guillermo Rico & Rolfe Sassenfeld, Advanced Modern Electronics, (print replica), 2019 Edition.
Type of Teaching:	2 hrs. in lectures 2 hrs. in practice
Pre-requisites:	None
Preparation Modules:	Analog Electronics Circuits
Frequency:	Spring Semester
Requirements for credit points:	For the award of credit points, it is necessary to pass the module requirements that contain: Examinations during the academic semester, Assignments, a Seminar and Final examination. **Student's attendance is required in all classes** (10% of absences results in withdrawing the student from the Final Exam).
Credit point:	5

Grade Distribution:	The following grade system is used for the evaluation of the module:
	The module exam is based on the summation of two categories of evaluations:
	First: (50%) of the mark is based on the academic semester effort which includes (35%) for Theoretical Part and (15%) for Practical Part distributed as following:
	    A) Theoretical Part:
	    - Three examinations during the academic semester, each out of 7%
	    - Two assignments each out of 4%
	    - One seminar out of 6%
	    B) Practical Part
	    - Eleven Reports each out of 1%
	    - Two quiz examinations each out of 2%
	Second: (50%) of the mark is based on final examination that is comprehensive for the whole of the study materials reviewed during the academic semester which includes (40%) for Theoretical Part and (10%) for Practical Part.

Work load:	The workload is 162 hrs. It is the result of 60 hrs. face-to-face study and 102 hrs. self-studies (Assignments, preparation for exam and applications).