Academic Year: 2023-2024	Semester: Fall	Starting Date: 15-10-2023
Course Name	Active Network Sysnthesis	
Module Language	English	
Instructor	Prof. Dr. Muhammed A. Ibrahim	
Teaching Assistance(s)	None	
College/University	College of Engineering – Salahaddin University-Erbil	
Department	Electrical	
Semester Duration	15 weeks	
Course Overview	Integrated circuit technology profoundly influences the design of networks for voice and data communication systems. Integrated circuit technology allows the realization of networks with small-size and low-cost resistors, capacitors, and active elements. These features have revolutionized the design of modern voice and data communication systems. More and more, the engineer is being faced with the challenges and problems of active-RC network design. The purpose of this module is to provide the knowledge to meet these challenges. The approach used in the module is to develop the fundamental principles of active and passive network synthesis in the light of practical design considerations. Active Network Synthesis is a particularly good vehicle for introducing many general design concepts, such as performance versus cost trade-offs, technological limitations, and computer aids. These ideas are presented in a simple way to allow assimilation by the graduate electrical engineer, and are closely related to the practical world of engineering.	
Course Objectives	The aim of this subject is to further develop skill and knowledge in the advance analysis and design of active electronic circuits. The conceptual knowledge gained in B.Sc. courses of analog electronics will be applied to specific use in real and more complicated circuits. The first part of the course will focus on filters and filter types, filter's transfer functions, poles, zeros, quality factor and pole frequency of the filters, filter approximations, and gain & phase distortions. The second part deals with the basic building blocks based on opamp, OTA, CFOA and CCII active elements. The third part of the course will focus on the sensitivity analyses involving single-parameter sensitivity and multi-parameter sensitivity functions and gain, phase & transfer function sensitivities. The last part of the course is devoted for methods of realizations of active networks that contain active-RC realization, active-R realization, OTA-C realization, MOS-C realization, CCII-RC realization and SC-realization. Students are required to have enough knowledge about Analog Electronics courses from B.Sc. Program before taking this course. This subject endeavors to teach students not only just how to solve circuit problems but also to develop a more thorough understanding of why circuits behave in a certain way and how performance can be improved.	

Course Contents	Week Lecture 1st Introduction 2nd Introduction to filters: Filters and filter types, Transfer function, Poles, zeros, quality factor & pole frequency, Filter Approximations, Gain & phase 3rd - 5th Basic Building Blocks-Operational amplifier (OPAMP)- based: Finite Gain amplifier, Unity gain amplifier, Inverting type of finite gain amplifier, Non-inverting type of finite gain amplifier, Summing point amplifier, Integrator, Gyrator, Negative impedance converter 6th Operational transconductance amplifier (OTA) 7th Second generation current conveyors (CCII) 8th Current feedback operational amplifier (CFOA) 9th Midterm Exam 10th-11th Sensitivity: Single-parameter sensitivity function, Multi-parameter sensitivity function, Gain, phase & transfer function sensitivities, Relations between sensitivities, Sensitivity measures. 11th -14th Methods of Realizations: Active-RC realization, Active-R realization, OTA-C realization, MOS-C realization, CCII-RC realization, SC- 15th Final Exam
Textbooks and References	• G. Daryanani, "Principles of Active Network Synthesis and Design", Wiley, 1976. • Hercules G. Dimopoulos, "Analog Electronic Filters: Theory, Design and Synthesis", Springer, New York, 2012. • Kendall Su, "Analog Filters", 2nd Edition, Kluwer Academic Publishers, Dordrecht, 2002. • R. Schaumann, M.S. Gausi, K.R. Laker, "Design of Analog Filters, Passive, Active, and Switched Capacitor", Printice Hall, 1990. • M.S. Gausi, K.R. Laker, "Modern Filter Design, Active RC and Switched Capacitor", Printice Hall, 1981. • Y. Sun, "Design of High frequency Integrated Analog Filters", The Institution of Electrical Engineers, London, 2002. • G. Ferri & N.C. Guerrini, "Low-Voltage Low-Power CMOS Current Conveyors", KLUWER Academic, 2003. • C. Toumazou, F.J. Lidgey & D.G. Haigh, "Analogue IC Design: the current-mode approach", Peter Peregrinnus Ltd, 1998. • Behzad Razavi, "Fundamentals of Microelectronics", Wiley, 2007. • T.C. Carusone, D.A. Johns & K.W. Martin, "Analog Integrated Circuit Design", 2nd Edition, Wiley, 2011. • Published Papers……..
Teaching Style	3 hrs. in Class
Requirements for credit points	For the award of credit points, it is necessary to pass the module exam. It contains: An examination during the academic semester, Quizzes, Assignments, and Final examination. **Student's attendance is required in all classes**.

Credit ECTS	6
Grade Distribution	The following grade system is used for the evaluation of the module exam: 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 - Midterm Exam = 20%. - Quizzes = 5% - Seminar = 10% - Review Article = 15% **Second: (50%)** of the mark is based on the final examination that is comprehensive for the whole of the study materials reviewed during the academic semester.
Workload	Workload 10hrs/w (150hrs/s): Contact face-to-face 3hrs/w (45hrs/s) and Non-Contact Self learning 7hrs/w (105hrs/s)