

Course Code	21ECC202T	Course Name	ANALOG AND LINEAR ELECTRONIC CIRCUITS	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ECE	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to:												Program Outcomes (PO)												Program Specific Outcomes																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
CLR-1:	understand the operation and design of transistor amplifier circuits for a given specification															1	2	3	4	5	6	7	8	9	10	11	12	Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
CLR-2:	discuss the elementary concepts and characteristics of an operational amplifier																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
CLR-3:	introduce the concepts of negative feedback on amplifier circuits, and investigate different feedback topologies to understand their properties, such as transfer gain, input resistances, and output resistances																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
CLR-4:	analyze and design RC and LC oscillator circuits																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
CLR-5:	analyze and design linear and non-linear applications of op-amp																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Course Outcomes (CO):		At the end of this course, learners will be able to:															2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Unit-1 - Single and Multistage Amplifiers	9 Hour
Bipolar Linear amplifier: Load line analysis, small-signal models, analysis of common-emitter, common-base, common-collector amplifiers and multistage amplifiers (cascade, cascode and Darlington) using Hybrid- π model, low- and high-frequency response of BJT amplifiers. MOSFET Linear Amplifier: Load line analysis, small-signal model, analysis of common-source, common-gate and common-drain amplifiers using hybrid- π model, low and high Frequency response analysis of MOSFET amplifier.	
Unit-2 - Introduction to Linear IC's	9 Hour
BJT and MOSFET differential amplifier with passive and active loads, Internal Structure of Op-amp, output stages and power amplifiers (Class-A and Class-AB push-pull Complementary amplifier configuration), Ideal operational amplifier, IC 741 packages, characteristics of op-amp, open-loop configurations, non-ideal effects in op-amp, Frequency response of an op-amp.	
Unit-3 - Feedback Amplifiers and Oscillators	9 Hour
Negative feedback amplifier: Introduction to feedback and types, advantages and disadvantages of negative feedback, basic feedback concepts, ideal feedback topologies, voltage (shunt- series) amplifier, current (shunt-series) amplifier, trans conductance (series-series) amplifiers, transresistance (shunt-shunt) amplifiers, stability analysis of the feedback Circuit (BJT/MOSFET/Op-amp). Oscillators: Principles of oscillation, classification of oscillators, RC, LC and Crystal oscillators (BJT/MOSFET/Op-amp)	
Unit-4 - Applications of Linear ICs - I	9 Hour
Summing amplifier, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier, voltage-to-current converter, current-to-voltage converter, comparators, Schmitt triggers and Non sinusoidal oscillators, active filters, first order and second order low and high pass filters, band-pass filters, band-stop filters, waveform generators.	

Unit-5 - Applications of Linear ICs - II**9 Hour**

Converters: Weighted -Resistor D/A and R-2R ladder D/A, Analog-to-Digital Converter: Successive approximation A/D Converters, precision rectifiers, clippers, and clamps. Specialized ICs: 555 Timer, functional block, 566 VCO and 565 PLL, Applications of PLL and 555 Timer, voltage regulators-LM78xx, LM79xx, LM723, LM380 power amplifiers.

Learning Resources	1. David A. Bell, "Electronic Devices and Circuits", 5th ed., Oxford University Press, 2015	5. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 5th ed., New Age International Pvt. Ltd., 2015
	2. Donald Neaman, "Electronic Circuits: Analysis and Design", 3rd ed., Mc-Graw-Hill Education, 2011	6. Ramakant A. Gayakwad, "Op-amp and Linear ICs", 4th ed., Printice Hall/Pearson, Education, 2015
	3. Muhammad Rashid, "Microelectronic Circuits: Analysis and Design", 2 nd ed., Cengage Learning, 2010	7. Sergio Franco, "Design with Operational amplifiers and Analog Integrated circuits", 4th ed., Tata McGraw-Hill, 2016
	4. Robert L. Boylestad Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th ed., Pearson Education, 2013	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	25%	-	25%	-	25%	-
Level 4	Analyze	25%	-	25%	-	25%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	5%	-	5%	-	5%	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. Saivineeth, ML Accelerator Architect@ Google	1. Dr. Meenakshi, Professor of ECE, CEG, Anna University, meena68@annauniv.edu	1. Dr. E. Sivakumar, SRMIST
2. Mr. Anuj Kumar, Program Delivery Manager, Nagarro Software Pvt. Ltd. Gurgaon, kumaranuj.anii@gmail.com	2. Dr Venkatesan, Sr. Scientist, NIOT, Chennai, venkat@niot.res.in	2. Mr. AVM. Manikandan, SRMIST