

B. E. (EC / TC)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – IV

ANALOG CIRCUITS

Subject Code	18EC42	CIE Marks	40
Number of Lecture Hours/Week	3+2 (Tutorial)	SEE Marks	60
		Exam Hours	03

CREDITS – 04

Course Learning Objectives: This course will enable students to:

- Explain various BJT parameters, connections and configurations.
- Design and demonstrate the diode circuits and transistor amplifiers.
- Explain various types of FET biasing, and demonstrate the use of FET amplifiers.
- Construct frequency response of FET amplifiers at various frequencies.
- Analyze Power amplifier circuits in different modes of operation.
- Construct Feedback and Oscillator circuits using FET.

Modules	RBT Level
Module -1	
<p>BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.</p> <p>Small signal operation and Models: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid II model.</p> <p>MOSFETs: Biasing in MOS amplifier circuits: Fixing V_{GS}, Fixing V_G, Drain to Gate feedback resistor.</p> <p>Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance.</p> <p>[Text 1: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.6), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.6)]</p>	L1, L2,L3
Module -2	
<p>MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance R_s, Source follower.</p> <p>MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model.</p> <p>Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.</p> <p>Oscillators: FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation)</p> <p>[Text 1: 4.7(4.7.1 to 4.7.4, 4.7.6) 4.8(4.8.1, 4.8.2, 4.8.3), 4.9, 12.2.2, 12.3.1, 12,3,2]</p>	L1, L2, L3
Module -3	
<p>Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis).</p> <p>Output Stages and Power Amplifiers: Introduction, Classification of output stages,, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier.</p> <p>[Text 1: 7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 13.1, 13.2, 13.3(13.3.1, 13.3.2, 13.3.3, 13.4, 13.7)]</p>	L1, L2, L3
Module -4	
<p>Op-Amp with Negative Feedback and general applications</p> <p>Inverting and Non inverting Amplifiers – Closed Loop voltage gain, Input impedance, Output impedance, Bandwidth with feedback. DC and AC Amplifiers, Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Comparators, Zero Crossing Detector, Schmitt trigger.</p> <p>[Text 2: 3.3(3.3.1 to 3.3.6), 3.4(3.4.1 to 3.4.5) 6.2, 6.5, 6.6 (6.6.1), 8.2, 8.3, 8.4]</p>	L1,L2, L3
Module -5	

<p>Op-Amp Circuits: DAC - Weighted resistor and R-2R ladder, ADC- Successive approximation type, Small Signal half wave rectifier, Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters.</p> <p>555 Timer and its applications: Monostable and a stable Multivibrators.</p> <p>[Text 2: 8.11(8.11.1a, 8.11.1b), 8.11.2a, 8.12.2, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 9.4.1, 9.4.1(a), 9.4.3, 9.4.3(a)]</p>	L1, L2, L3
<p>Course Outcomes:At the end of this course students will demonstrate the ability to</p> <ul style="list-style-type: none"> • Understand the characteristics of BJTs and FETs. • Design and analyze BJT and FET amplifier circuits. • Design sinusoidal and non-sinusoidal oscillators. • Understand the functioning of linear ICs. • Design of Linear IC based circuits. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks. • Each full question can have a maximum of 4 sub questions. • There will be 2 full questions from each module covering all the topics of the module. • Students will have to answer 5 full questions, selecting one full question from each module. • The total marks will be proportionally reduced to 60 marks as SEE marks is 60. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford, 2015.ISBN:978-0-19-808913-1 2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition. Pearson Education, 2000. ISBN: 8120320581 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0. 2. Fundamentals of Microelectronics, BehzadRazavi, 2nd Edition, John Wiley, 2015, ISBN 978-81-265-7135-2 3. J.Millman&C.C.Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5 	