**23EE12T1-ANALOG CIRCUITS**

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| **Course Category:** | Engineering science | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basic knowledge of semiconductor physics. | **Sessional Evaluation: Univ. Exam Evaluation:**  **Total Marks:** | 30  70  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn: | | |
| 1. The concepts of diode clipping and clamping circuits, different amplifier configurations, operation of oscillator circuits, operational amplifiers, timers, ADC and DAC. 2. To apply the above concepts for different circuit design. 3. To analyze various circuit characteristics by using Amplifiers, Transistors, Comparators, Wave form generators, ADC and DAC 4. To analyze various circuit characteristics by using timers, Phase locked loops and operational amplifiers. 5. Evaluate different system configurations by using various amplifier, transistor and waveform generators | | |
| **Course Outcomes** | At the end of this course the students are expected to understand | | **Blooms Level** |
| CO1 | Understand the concepts of diode clipping and clamping circuits, different amplifier configurations, operation of oscillator circuits, operational amplifiers, timers, ADC and DAC | **L2** |
| CO2 | Apply the above concepts for different circuit design. | **L3** |
| CO3 | Analyze various circuit characteristics by using Amplifiers, Transistors, Comparators, Wave form generators, ADC and DAC | **L4** |
| CO4 | Analyze various circuit characteristics by using timers, Phase locked loops and operational amplifiers | **L4** |
| CO5 | Evaluate different system configurations by using various amplifier, transistor and waveform generators | **L5** |
| **Course Content** | **UNIT I**  **Diode clipping and clamping circuits:** Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.  **DC biasing of BJTs:** Load lines, Operating Point, Bias Stability, Collector-to- Base Bias, Self-Bias, Stabilization against Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability. | | |

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| **Course Content** | **UNIT II**  **Small Signals Modeling of BJT:** Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.  **Feedback Amplifiers:** Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.  **UNIT III**  **Oscillator Circuits:** Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.  **Operational Amplifiers:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op- amp & its features.  **UNIT IV**  **OP-AMPS Applications:** Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.  **Comparators and Waveform Generators:** Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.  **UNIT V**  **Timers and Phase Locked Loop:** Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).  **Digital To Analog And Analog To Digital Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications. |
| **Text Books & References Books** | **Textbooks:**   1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc- Graw Hill, 2nd Edition, 2010. 2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd   Edition, 2003.  **Reference Books:**   1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021. 2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017. 3. Electronic Devices and Circuits – David Bell, Oxford, 5th Edition, 2008. 4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, |

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|  | McGraw-Hill/Higher Education, 2007.   1. Operational Amplifiers and Linear Integrated Circuits – Gayakwad R.A, Prentice Hall India, 2002. 2. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria & Sons, 2nd Edition, 2010. 3. Design of Analog CMOS Integrated Circuits - Behzad Razavi |
| **e-Resources:** | 1. <https://nptel.ac.in/courses/122106025>. 2. <https://nptel.ac.in/courses/108102112>. |