# Analog Electronic Circuits

**Course Code:** BEECE2C003

**Course Title:** Analog Electronic Circuits

**Semester:** III

## Credits: 04

**Rationale**

To acquaint the students with the fundamental principles of operation and design of analog circuit building blocks and their use in analog circuit design

## Course Outlines

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| **Contents** | **No. of Lectures** |
| **Unit - I**  Discrete Circuits: Biasing and Design of BJT (CE, CB, and CC) and FET (CS, CG, and CD)Amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features. Small-Signal Equivalent Circuits: Diode, BJT, and FET; Review of large signal I-V relations, transconductance, output resistance, device capacitances, transit frequency | **8** |
| **Unit - II**  **Introduction to Op-amps:** Block diagram of a typical Op-Amp, Schematic symbol, Characteristics and performance parameters of ideal Op-Amp, Open loop configurations: Differential, Inverting & Non Inverting. Practical Op-Amp: offset voltage analysis and compensation, input bias and offset current analysis and compensation, Change in Input offset voltage and Input offset current with time, Temperature and supply voltage, Common mode configuration and Common mode rejection Ratio, Frequency response, slew rate | **8** |
| **Unit - III**  **Op-amp Applications:** DC and AC amplifiers, Peaking amplifiers, Summing, Scaling and Averaging amplifiers, Differential amplifier, Instrumentation amplifiers, V to I and I to V converters, Differentiator and integrator, A to D and D to A converters, Log and antilog amplifiers, Sample and hold circuits,  **Active Filters**: Low pass, high pass, band pass and band stop, design guidelines. Schmitt trigger and its applications. | **8** |
| **Unit - IV**  High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin. | **10** |
| **Unit – V**  **Oscillators :** Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.  **Specialized ICs:** Phase Locked Loop- Operating principles and applications, 555 Timer- its applications as Monostable and Astable multivibrators. | **8** |

**Course Outcomes**

Upon successful completion of this course, candidates will be able to:

* Learn and able to apply small signal BJT and FET analysis
* Analyze and learn the basic concept of operational amplifiers and its applications
* Understand the basic concept of frequency response of amplifiers
* Learn and understand the use of feedback amplifiers
* Learn and understand the use of oscillators and specialized ICs

## Text Books/ Reference Books

1. A. S. Sedra and K. C. Smith, *Microelectronic Circuits: Theory andApplications*, 7th edition. Oxford, 2017.
2. B. Razavi, *Fundamentals of Microelectronics*, 2nd edition. Wiley-India, 2014.
3. R. L. Boylestad and L. Nashelsky, *Electronic Devices and CircuitTheory*, 11th edition. Pearson, 2013.
4. T. C. Carusone, D. Johns, and K. Martin, *Analog Integrated CircuitDesign*, 2nd edition. Wiley-India, 2013.
5. P. R. Gray, P. J. Hurst, S. H. Lewis, and R. G. Meyer, *Analysis andDesign of Analog Integrated Circuits*, 5th edition. Wiley-India, 2009.
6. D. A. Neamen, *Electronic Circuits: Analysis and Design*, 3rd edition.Tata McGraw-Hill, 2008.

# Analog Electronic Circuits Lab

**Course Code:** BEECE1C003P

# Course Title: Analog Electronic Circuits Lab

## Semester: I

## Credits: 01

**Rationale**

This course provide exposure to the students with Ability to design and analyze fundamental circuits based on op-amps, Ability to implement various analog circuits using OP-AMP such as waveform generators, filters, integrator etc, Potential to use 555 timer IC in different configurations,Potential to demonstrate the operation of VCO and PLL

## Course Outlines

* To experimentally study the performance of inverting, non-inverting and differential amplifier-using op-amp.
* To experimentally study the performance of op-amp as summing, scaling and averaging amplifier.
* To demonstrate working of an op-amp as a voltage level detector.
* To demonstrate working of an op-amp as a square wave generator.
* To demonstrate working of an op-amp as a triangular and saw-tooth wave generator.
* To demonstrate working of an op-amp as Schmitt trigger.
* To demonstrate working of an op-amp as a low pass filter.
* To demonstrate working of an op-amp as a high pass filter.
* To demonstrate working of an op-amp as an integrator.
* To demonstrate working of an op-amp as a differentiator.
* To demonstrate the operation of a 555 timer as monostable multivibrator.
* To demonstrate the operation of a 555 timer as astablemultivibrator.
* To demonstrate the operation of VCO as Voltage to frequency characteristics of 566 IC.
* To demonstrate the operation of PLL as Frequency multiplication using 565 IC.

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