

**2EE02: ANALOG ELECTRONICS**

**CREDITS - 3 (LTP:3,0,0)**

**Course Objectives:**

The subject aims to provide the student with:

1. Understanding of concepts and principles of Analog circuits.
2. Ability to solve complex circuits using different applications of op-amp.
3. Advanced understanding of electronics, linear and nonlinear electronic circuits which will be useful for advance Subjects.

**Teaching and Assessment Scheme:**

Teaching Scheme (Hours per week)			Credits	Marks Distribution				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
			ESE		CE	ESE	CE	
3	0	0	3	60	40	0	0	100

**Course Contents:**

Unit No.	Topics	Teaching Hours
1	<b>Diode circuits</b> P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits	04
2	<b>BJT circuits</b> Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits	07
3	<b>MOSFET circuits</b> MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits-gain, input and output impedances, trans-conductance, high frequency equivalent circuit.	07
4	<b>Differential, multi-stage and operational amplifiers</b> Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-dualities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product	08
5	<b>Linear applications of op-amp</b> Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P,PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift).	08
6	<b>Nonlinear applications of op-amp</b> Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.	06
<b>Total</b>		<b>40</b>

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### **List of References:**

1. A.S. Sedra and K.C.Smith, "*Microelectronic Circuits*", New York, Oxford University Press, 1998.
2. J.V.Wait, L. P. Huelsman and G.A.Korn, "*Introduction to Operational Amplifier theory and applications*", McGraw Hill U.S., 1992.
3. J. Millman and A.Grabel, "*Microelectronics*", McGraw Hill Education, 1988.
4. P. Horowitz and W.Hill, "*The Art of Electronics*", Cambridge University Press, 1989.
5. P.R.Gray, R.G.Meyer and S.Lewis, "*Analysis and Design of Analog Integrated Circuits*", John Wiley & Sons, 2001.

### **Course Outcomes:**

At the end of this course, students will demonstrate the ability to

1. Understand the characteristics of transistors.
2. Design and analyses various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMP and design OP-AMP based circuits.