SUBJECT NAME: BASICELECTRONICS

Subject Code: BE2101

Semester: 1st / 2nd

Branch: I&E, ECE, ETC, EEE, EL

By

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Course Outcome(CO) of Basic Electronics (BE 2101)

1. Learn what is signal, it's types and it's implementation in electronics.
2. Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, diodes and transistors.
3. Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation and filtering on electronic signals.
4. Gain an intuitive understanding of the working principle of diodes, transistors and their applications in electronic circuits.
5. Become adept at using various methods of circuit analysis, including voltage and current dividers, and the node method for BJTs.
6. Appreciate the consequences of linearity, KVL, KCL, the principle of superposition and Thevenin equivalent circuits.
7. Be introduced to the concepts of both positive and negative feedback in electronic circuits.
8. Learn how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator.
9. The students will be able to identify the different components of a CRO and signal generator.
10. The students will be able to identify or differentiate between different digital gates. Acquire experience in building simple electronic digital circuits.
11. They will also be able to design basic digital combinational circuits.

Syllabus of Basic Electronics (BE 2101)

BE2101 - Basic Electronics
(3 – 0 – 0; Credits: 3; Contact Hours: 3)

MODULE – I (11 hours)

1. Introduction to Electronics: Signals, Frequency spectrum of signals, Analog and digital signals, Amplifiers, Digital logic inverters. (1.1 to 1.4 and 1.7 of Sedra and Smith) (1 Lectures)
2. The Operational Amplifier (Op-Amp): The ideal Op-Amp, Inverting and non-inverting configurations, Difference amplifier, CMRR, Application of Op-Amp (Instrumentation amplifier, Summing amplifier, Integrator and Differentiator). (2.1 to 2.4 and 2.8 of Sedra and Smith) (3 Lectures)
3. Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Diode clipper and clamper circuits, Light emitting diodes. (3.7, 3.2, 3.4 to 3.6 and 3.8 of Sedra and Smith) (4 Lectures)
4. Bipolar Junction Transistors (BJTs): Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Current-voltage characteristics of BJT, BJT as an amplifier and as a switch. (5.1 to 5.3 of Sedra and Smith) (3 Lectures)

MODULE – II (11 hours)

5. Bipolar Junction Transistors (BJTs): BJT Circuits at DC, Biasing in BJT amplifier circuits, Small Signal Operation of BJT: Simplified hybrid-p model and its application to single stage BJT amplifiers (Common Emitter, Common-Base and Common-Collector configurations).
(5.4 to 5.7 of Sedra and Smith) (4 Lectures)
6. Feedback Amplifiers and Oscillators: General feedback structure, Properties and advantages of negative feedback, Basic principles of sinusoidal oscillators, The Barkhausen criterion, Op-Amp Oscillator circuits (Wien-Bridge oscillator, RC phase-shift oscillator and Crystal oscillator). (8.1, 8.2 and 13.1 to 13.3 of Sedra and Smith) (4 Lectures)
7. Electronic Instruments: Basic principle of Oscilloscope, Function of the sweep generator, Block diagrams of oscilloscope, Simple CRO, Measurement of frequency and phase by Lissajous method, Application of oscilloscope for measurement of voltage, period and frequency, Block diagram of standard signal generator, AF sine and square wave generator, and Function generator.(7.2 to 7.5, 7.20,7.26, 7.30, 8.5, 8.7 and 8.8 of Kalsi) (3 Lectures)

MODULE – III (10 hours)

Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic. (1.2, 1.3 and 2.2 to 2.4 of Floyd and Jain) (2 Lectures)

8. Logic Gates and Boolean Algebra: The inverter, The AND, OR, NAND NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table. (3.1 to 3.6 , 4.1 to 4.7 of Floyd and Jain) (4 Lectures)

9. Combinational Logic and Their Functions: Basic combinational logic circuits, Implementation of combinational logic, The universal properties of NAND and NOR gates, Basic adders, Multiplexers and Demultiplexers., Elementary treatment of Latches, Basic concepts of Memory (RAMs) (5.1 to 5.4, 6.2, 6.4, 6.8, 6.9, 7.1 and 10.2 of Floyd and Jain) (4 Lectures)

Text Books:

1. Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford University Press, YMCA Library Building Jai Singh Road, New Delhi – 110 001.

2. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.

3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books:

4. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092 (Selected Portions).

5. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.

6. Electronics Principles (7^{th} Edition), Albert Malvono and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi

LESSION PLAN

Subject Name : **Basic Electronics** Subject code : **BE2101**

Module	Lecture No.	Topics to be covered
I	1.	Introduction to Electronics
	2.	The ideal Op-Amp, Inverting and non-inverting configurations
	3.	Difference amplifier, CMRR, Application of Op-Amp - Instrumentation amplifier
	4.	Application of Op-Amp- Summing amplifier, Integrator and Differentiator
	5.	Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes
	6.	Characteristics of p-n junction diodes, Zener diode
	7.	Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers)
	8.	Diode clipper and clamper circuits, Light emitting diodes
	9.	Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region
	10.	Current-voltage characteristics of BJT
	11.	BJT as an amplifier and as a switch
II	12.	BJT Circuits at DC
	13. & 14.	Biasing in BJT amplifier circuits
	15.	Small Signal Operation of BJT: Simplified hybrid-p model and its application to single stage BJT amplifiers (Common Emitter, Common-Base and Common-Collector configurations).
	16.	General feedback structure
	17.	Properties and advantages of negative feedback, Basic principles of sinusoidal oscillators, The Barkhausen criterion,
	18.	Op-Amp Oscillator circuits (Wien-Bridge oscillator)
	19.	Op-Amp Oscillator circuits (RC phase-shift oscillator and Crystal oscillator)
	20.	Basic principle of Oscilloscope, Block diagrams of oscilloscope, Simple CRO
	21.	Function of the sweep generator, Measurement of frequency and phase by Lissajous method, Application of oscilloscope for measurement of voltage, period and frequency
	22.	Block diagram of standard signal generator, AF sine and square wave generator, and Function generator

III	23.	
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