Fundamentals of Electronics and Communication Engineering		Semester	I
Course Code	1BECE105/205	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Apply the working principles, fundamental characteristics of various semiconductor devices including diodes, transistors and operational amplifiers in basic electronic circuits.
2. Analyze basic rectifier and amplifier circuits using the principles of diodes, BJTs, and operational amplifiers.
3. Illustrate the fundamental concepts of communication systems and their applications.
4. Design basic combinational circuits using the fundamental principles of digital systems.
5. Analyze the fundamental concepts of electronic circuits, communication systems, and digital systems for their role in building basic electronic applications.

Module-1

Diodes and Their Application: Introduction, Characteristics and Parameters, Diode Approximation, DC Load Line Analysis, Half Wave Rectifier, Full Wave Bridge Rectifier, Capacitor Filter Circuit (Only Qualitative Approach), Zener Diode and Its Use in Voltage Regulation, Diode Logic Circuit.

Text 1: 2.1, 2.2, 2.3, 2.4, 2.9, 3.1, 3.2, 3.3, 3.7, 3.12. Number of Hours:8

Module-2

Bipolar Junction Transistors: Introduction, BJT Voltages & Currents, BJT Amplification, BJT Switching, Common Base Characteristics, Common Emitter Characteristics, BJT Biasing, Fixed Biasing and Voltage Divider, DC Load Line and Bias Point.

Field Effect Transistor: Junction Field Effect Transistor (N-Channel), JFET Characteristics, MOSFETS: Enhancement MOSFETs.

Case Study MOSFET as a Switch.

Text 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 5.1,5.2, 5.4, 9.1, 9.2, 9.5. Number of Hours:8

Module-3

Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol,

Op-Amp Parameters: Gain, Input Resistance, Output Resistance, CMRR, Slew Rate, Bandwidth, Input Offset Voltage, Input Bias Current and Input Offset Current, The Ideal Op-Amp, Equivalent Circuit of Op-Amp, Open Loop Op-Amp Configurations, Differential Amplifier, Inverting & Non Inverting Amplifier

Op-Amp Applications: Inverting Configuration, Non-Inverting Configuration, Differential Configuration, Voltage Follower, Integrator, Differentiator.

Text 2: 1.2, 1.3, 1.5, 2.2, 2.3, 2.4, 2.5, 2.6, 6.5, 6.12, 6.13. Number of Hours:8

Module-4

Fundamentals Of Communication: Elements of a Communication System, Communication Channels and Their Characteristics: Wireline, Fiber Optic, Wireless Electromagnetic Channels

Introduction to Analog Modulation Types: Amplitude Modulation, Frequency and Phase Modulation, Waveforms. (Excluding Derivation and Spectral Diagrams)

Applications: AM Radio Broadcasting, Superheterodyne FM Receiver, Mobile Wireless Telephone Systems**.**

Case Study of Converting Analog Signal to Digital Signal Using PCM

Text 3: 1.2, 1.3, 3.1.

Text 4: 3.5, 4.4.1, 4.5, 18.3.1, 18.3.2. Number of Hours:8

Module-5

Digital Systems and Binary Numbers: Digital Systems, Numbering System (Binary, Octal, Decimal and Hexadecimal), Number Base Conversion – (Binary to Decimal, Hexadecimal And Vice Versa), 1's and 2's Complement Operation, Signed Binary Numbers-Arithmetic Addition and Subtraction, Binary Logic.

Boolean Algebra: Basic Definitions, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates (Excluding Extension to Multiple Inputs, Positive and Negative Edge) NAND And NOR As Universal Gates (Excluding Multilevel Presentation), Binary Adders. (Half Adder and Full Adder)

Case Study with 4-Bit Adder Simulation

Text 5: 1.1,1.2, 1.3, 1.4, 1.5, 1.6, 1.9, 2.2,2.4, 2.5, 2.6, 2.8, 3.6, 4.5. Number of Hours:8

Suggested Learning Resources: (Text Books)

1. David A Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 30th Impression, 2025.
2. Ramakanth A Gayakwad, Op-amps and Linear Integrated Circuits, 4th Edition, Pearson Education, 2015.
3. John G. Proakis, Masoud Saleh, Fundamentals of Communication Systems, Second Edition, Pearson Educations, Inc., 2014.
4. D.P Kothari and I J Nagrath, Basic electronics, Second Edition, McGraw Hill Education Pvt ltd, 2018.
5. M.Morris Mano and Michael D.Ciletti, Digital Design - With an Introduction to the Verilog HDL, VHDL and System Verilog 6th Edition, Pearson Education Inc, 2024.

Reference Book

1. Mike Tooley, Electronic Circuits, Fundamentals & Applications, 5th Edition, Elsevier, 2020.
2. Albert Malvino, Electronic Principles, 9th Edition, McGraw Hill Publications, 2021.
3. Electronic Devices and Circuit Theory, R Nashelsky and L Nashelsky, 11th Edition, Pearson, 2012

Web links and Video Lectures (e-Resources):

- Introduction to Basic Electronics: https://nptel.ac.in/courses/122106025
- Digital Electronic Circuits https://nptel.ac.in/courses/108105132

Teaching-Learning Process (Innovative Delivery Methods)

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various analog and digital circuits.
3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
4. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
5. Arrange visits to nearby industries to give brief information about the electronics manufacturing industry.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.

Notwithstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Note: The Case Studies provided in Modules 2, 4 and 5 are only meant to motivate the application of concepts to students and will not appear in the SEE

Continuous Comprehensive Evaluation (CCE):

CCE will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.

Learning Activity 1: (Marks 25): Two assignments (for 10marks and 15marks) with circuit simulation using any simulation tool (e.g. LTSpice, KICad etc.) related to the case studies in Module 2, 4 and 5. Assignments should be at RBL3, RBL4, or RBL5 levels, assignment reports should include circuit design, schematic, and simulation results.

OR

Learning Activity 2: (Marks 25): A group Mini-project using discrete components and demonstrating MOSFET as a switch for controlling a load (e.g. motor or LED). An experimental demonstration is required and a report which includes theory of MOSFET operation as a switch, circuit design and calculations. The MOSFET part number to be provided by the faculty.

Rubrics for Assignment (scale total to 10 marks or 15 marks as required)

	Superior	Good	Fair	Needs Improvement	Unacceptable
Demonstrates an Understanding of Simulation Concepts – 10 marks	Explains simulation concepts clearly, accurately, and with insightful connections **(10)**	Explains simulation concepts accurately with minor gaps in detail **(8)**	Shows basic understanding of simulation concepts but lacks depth or has some inaccuracies **(6)**	Understanding is limited, with errors or confusion **(4)**	Shows little or no grasp of the simulation concepts **(2)**
Able to Apply Laws/Equations and Correct Methodology – 10 marks	Applies laws/equations flawlessly with correct and efficient methodology **(10)**	Applies laws/equations correctly with minor methodological lapses **(8)**	Applies laws/equations partially correctly; some steps or logic missing **(6)**	Frequent errors in applying laws/equations or methodology **(4)**	Unable to apply laws/equations or follow correct methodology **(2)**
Performs Accurate Calculations, Simulations and Provides precise Answers – 10 marks	All calculations and simulations are accurate; answers precise and in correct format/units **(10)**	Minor calculation and simulation errors; answers mostly precise and correctly formatted **(8)**	Some correct calculation/simulations but noticeable errors; precision inconsistent **(6)**	Frequent calculations/simulation errors; answers often imprecise or incomplete **(4)**	Calculations/Simulations mostly incorrect; answers missing or irrelevant **(2)**

Rubrics for Mini-project

	Superior	Good	Fair	Needs Improvement	Unacceptable
Student has a well defined problem statement and a good technical report– 5 marks	Problem statement and mini-project report are clear, specific, and well-justified with context **(5)**	Problem statement and mini-project report are clear and specific but lacks strong justification **(4)**	Problem statement and mini-project report are understandable but somewhat vague or incomplete **(3)**	Problem statement and mini-project report are unclear or too broad **(2)**	No clear problem statement provided and poor mini-project report **(1)**
The design provided by the student meets requirement– 10 marks	Design fully meets all requirements with optimal functionality **(10)**	Design meets most requirements; minor gaps in functionality **(8)**	Design meets basic requirements but with noticeable limitations **(6)**	Design meets few requirements; significant shortcomings **(4)**	Design does not meet requirements or is non-functional **(2)**
Hardware circuit set up and demonstration is as per requirements– 10 marks	Hardware setup is correct, neat, and demonstration fully meets requirements **(10)**	Setup is correct with minor issues; demonstration meets most requirements **(8)**	Setup partially correct; demonstration meets basic requirements only **(6)**	Setup has major errors; demonstration incomplete or unclear **(4)**	Setup incorrect or missing; no meaningful demonstration **(2)**

Suggested Learning Activities May Include (but are not limited to):

- Course Project
- Case Study Presentation
- Programming Assignment
- Tool/Software Exploration
- Literature Review
- Open Book Test (preferably at RBL4 and RBL5 levels)
- GATE-based Aptitude Test
- Assignment (at RBL3, RBL4, or RBL5 levels)
- Any other relevant and innovative academic activity
- Use of MOOCs and Online Platforms

Suggest Innovative Deliver Methods May Include (but are not limited to):

- Flipped Classroom
- Problem-Based Learning (PBL)
- Case-Based Teaching
- Simulation and Virtual Labs
- Partial Delivery of course by Industry expert/ industrial visits
- ICT-Enabled Teaching
- Role Play