Gyanmanjari Innovative University

Syllabus
Gyanmanjari Institute of Technology
Semester-1

**Subject:** Basics of Electronics Engineering: Concepts and Applications - BET1EE11301

**Type of course:** Major (Core)

**Prerequisite:** Basic knowledge of Physics and Mathematics.

**Rationale:** The course is designed to provide Elementary concepts of Electronics Engineering to engineering students. Electronics is the cornerstone of modern technology, playing a vital role in nearly every aspect of contemporary life—from communication systems, healthcare, and transportation to entertainment, industry, and automation. A deep understanding of electronics is essential for students, engineers, and professionals who aspire to innovate and contribute effectively in the 21st-century technological landscape. Without it, modern civilization as we know it would be impossible.

## Teaching and Examination Scheme:

| Teaching Scheme | | | Credits | Examination Marks | | Total Marks |
|---|---|---|---|---|---|---|
| CI | T | P | C | SEE | CCE | |
| 2 | 0 | 4 | 4 | 100 | 50 | 150 |

*Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; LWA - Lab Work Assessment; V – Viva voce; CCE-Continuous and Comprehensive Evaluation; ALA- Active Learning Activities.*

## Course Content:

| Sr. No | Course Content | Hrs. | % Weightage |
|---|---|---|---|
| 1 | **Semiconductor Diodes and Rectifiers**<br>**Topics:**<br>• Semiconductor basics (P-type, N-type)<br>• PN Junction diode and its characteristics.<br>• Diode Equivalent Circuit<br>• Zener diode<br>• Light Emitting Diode<br>• Sinusoidal Inputs: Half-Wave Rectification | T:08<br>P:12 | 25% |

- Full-wave Rectification
- Clipper
- Clamper

**Practical**

| Sr. No. | Practical Task | Tools Used | Outcome |
|---|---|---|---|
| 1 | Plot the V-I characteristics of a PN junction diode | kit +Multimeter | Understand the diode's behavior in forward and reverse bias by plotting its V-I characteristics. |
| 2 | Verify characteristics of a Zener diode for Forward and Reverse Bais condition | kit +Multimeter Multisim Software / LT spice | Analyze the reverse breakdown region of a Zener diode through its V-I characteristics. |
| 3 | Zener diode as a voltage regulator | kit +Multimeter Multisim Software / LT spice | Demonstrate the use of a Zener diode to maintain a constant output voltage despite load or input changes. |
| 4 | To demonstrate how LED works in a simple circuit. | Kit +Multimeter Multisim Software / LT spice | Apply knowledge of circuit fundamentals to build and test an LED circuit using resistors and a power supply. |
| 5 | Half-wave rectifier using a diode | kit +Multimeter Multisim Software / LT spice | Observe the conversion of an AC input into a pulsating DC output using a single diode. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6 | Full-wave rectifier | kit +Multimeter Multisim Software / LT spice | Verify the full-wave rectification of an AC signal to improve efficiency. | | |

**Evaluation Method**

| Sr. No. | Evaluation Component | SEE (Marks) | CCE (Marks) | Description |
|---|---|---|---|---|
| 1 | Circuit Assembly and connection on Software | 10 | – | Students will design and simulate a given circuit and verify output. |
| 2 | Problem-solving on zener diode. | 05 | | Students will solve problem based on Zener as Regulator depending on a given condition |
| 2 | Active Learning Activity (Component Identification) | - | 05 | Identify the given component and read its values. |
| 3 | Performance comparison of Rectifiers. | – | 05 | Students will compare different type of Rectifier and upload Report on GMIU web Portal. |
| | Total | 15 | 10 | |

| | | | |
|---|---|---|---|
| **2** | **Bipolar junction transistors**<br>**Topics:**<br>• Transistor Construction(NPN and PNP)<br>• Transistor Operation<br>• Operating modes: Active, Saturation, and Cut-off | **T:07 P:12** | **15%** |

- Common-Base Configuration
- Common-Collector Configuration
- Common-Emitter Configuration
- BJT as an amplifier and switch

**Practical**

| Sr. No. | Practical Task | Tools Used | Outcome |
|---|---|---|---|
| 1 | Identify the terminals of the BJT using the datasheet and a multimeter | Multimeter + Datasheets | Learn BJT pin configuration and types |
| 2 | Plot the input/output characteristics of the BJT in the CB configuration | Virtual Lab | Analyze the input-output relationship of BJT |
| 3 | Plot the input/output characteristics of the BJT in the CE configuration | Virtual Lab | Analyze the input-output relationship of BJT |
| 4 | Verify the transistor as a switch | Multisim Software & LT spice | Observe transistors as a Switch. |
| 5 | Set up the transistor amplifier circuit | Virtual Lab | Observe signal amplification |

**Evaluation Method**

| Sr. No. | Evaluation Component | SEE (Marks) | CCE (Marks) | Description |
|---|---|---|---|---|
| 1 | Problem - solving | 10 | – | Numerical, based on BJT operation, modes, and amplifier design |
| 2 | Active Learning Activities (Judge and Draw) | | 10 | The clue will be given to the students, the Judge, and the circuit will be drawn in a group |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | of 3 or 4, and upload it to the GMIU Web Portal | | |
| | | Total | 10 | 10 | | | |

**3 Field Effect Transistor** — **T:07 P:12** — **20%**

**Topics:**

- Construction and Characteristics of FET
- Transfer Characteristics
- Depletion-type MOSFET
- Enhancement Type MOSFET.

**Practical**

| Sr. No. | Practical Task | Tools Used | Outcome |
|---|---|---|---|
| 1 | Study MOSFET as a switch | Proteus or Multisim | Learn the switching behavior; ON/OFF control via gate voltage |
| 2 | Simulate FET characteristics | Proteus or Multisim | Virtual observation of JFET/MOSFET behavior; reinforce theory with simulation |
| 3 | Design and simulate a JFET amplifier | Proteus or Multisim | Observe amplified output. |
| 4. | Simulate an application-based circuit | Proteus / Multisim | Apply Knowledge in a simple application |

**Evaluation Method**

| Sr. No. | Evaluation Component | SEE (Marks) | CCE (Marks) | Description |
|---|---|---|---|---|
| 1 | Designing of circuit in software tool | 10 | – | Simulation FET circuit Design in software tool |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2 | Active Learning Activities Component Hunt: Identify 5 real-world devices that use diodes, transistors, or MOSFETs (e.g., TV, inverter, charger).) | – | 5 | Understand the practical use of components and upload findings on the portal. | | |
| | 3 | Viva Voce | – | 5 | Oral questions | | |
| | | Total | 10 | 10 | | | |
| **4** | **Operational Amplifier**<br>**Topics:**<br>• op-amp Introduction<br>• Inverting Amplifier<br>• Non Inverting Amplifier<br>• op-amp Application.<br><br>**Practical** | | | | | **T:08**<br>**P:12** | **20%** |

| Sr. No. | Practical Task | Tools Used | Outcome |
|---|---|---|---|
| 1 | op-amp in Inverting Mode | Proteus or Multisim | Understand phase inversion and gain control. |
| 2 | op-amp in Non-Inverting Modes | Proteus or Multisim | Analyze signal amplification without phase shift. |
| 3 | Op-amp as Summer Amplifier | Proteus or Multisim | Perform multiple input voltage addition. |
| 4 | Integrator | Proteus or Multisim | Understand integration of input waveform over time. |

| | | | | |
|---|---|---|---|---|
| 5 | Differentiator | Proteus or Multisim | Analyze rapid signal changes and output response. | |

**Evaluation Method**

| Sr. No. | Evaluation Component | SEE (Marks) | CCE (Marks) | Description |
|---|---|---|---|---|
| 1 | Design a Specific Function using Op-amp | 10 | | Students research, design, simulate and then build and test their circuits and explain their results. |
| 2 | Analyze the given circuit Parameter | 05 | | Students need to find parameters (like gain) of a given circuit |
| 3 | Quiz (MCQ – Conceptual & Circuit-based) | – | 05 | Questions on Op-Amp basics |
| 4 | Fault-Finder: What's Wrong with The Circuit? | | 05 | Students identify the error, and propose a correct solution. |
| | Total | 15 | 10 | |

**5** **Feedback and Oscillator Circuit** — **T:08 P:12** — **20%**

**Topics:**

- Feedback connection Types
- Oscillator Operation
- RC, LC Oscillator
- Wien's Bridge Oscillator
- Tuned Oscillator
- Crystal oscillator

**Practical:**

| Sr. No. | Practical Task | Tools Used | Learning Outcome |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | To design, simulate, and analyze RC oscillators | Proteus or Multisim | Design, simulate, and analyze RC oscillators in Multisim. |
| 2 | To simulate simple LC oscillators, | Proteus or Multisim | Design, simulate, and analyze LC oscillators in Multisim |
| 3 | To simulate a crystal oscillator | Proteus or Multisim | Perform crysta! oscillator Analysis |

**Evaluation Method**

| Sr. No. | Evaluation Component | SEE (Marks) | CCE (Marks) | Description |
|---|---|---|---|---|
| 1 | Computational Analysis of Oscillator Circuits | 10 | - | Compute Parameters of given Oscillator and verify them Through Simulation |
| 2 | Performance Prediction | | 5 | Simulation of any Oscillator predicting how an oscillator will perform under various operating conditions (temperature, voltage, load). |
| 3 | Comparison between different Types of Feedback. | | 5 | Preparation of Poster |
| | Total | 10 | 10 | |

## Project

### Objective

To enhance practical understanding and design thinking by allowing students to apply fundamental electronics concepts in a real-world mini project. Students will build simple functional circuits, simulate operations, and present their ideas—developing teamwork, documentation, and problem-solving skills.

**Evaluation Method**

| Sr. No. | Evaluation Component | SEE (Marks) | CCE (Marks) | Description |
|---|---|---|---|---|
| 1 | **Report** | 5 | – | Submit a concise report covering circuit design, components used, working principle, and observations. |
| 2 | **Presentation** | 10 | – | Present the project idea, working logic, and relevance through slides or a live demo. |
| 3 | **Model Working** | 15 | – | Evaluate based on correct implementation, functionality, and simulation (if applicable). |
| 4 | **Viva Voce** | 10 | – | Oral questions on circuit behavior, design logic, and individual contribution. |

## Suggested Specification Table with Marks:

| Distribution of Marks (Revised Bloom's Taxonomy) | | | | | | |
|---|---|---|---|---|---|---|
| Level | Remembrance (R) | Understanding (U) | Application (A) | Analyze (N) | Evaluate (E) | Create (C) |
| Weightage % | 10% | 15% | 20% | 10% | 15% | 30% |

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the evaluation may vary slightly from the above table.

## Course Outcome:

| After learning the course, the students should be able to: | |
|---|---|
| CO1 | Analyze PN junction, Zener, and LEDs, their characteristics, equivalent circuits, and apply them in half-wave and full-wave rectification |
| CO2 | Familiarize with NPN and PNP transistors, and analyze their behavior in common-base, common-emitter, and common-collector configurations for use as Switches and amplifiers |
| CO3 | Illustrate the construction and characteristics of FETs, interpret their transfer characteristics, and differentiate between depletion and enhancement type MOSFETs for various electronic applications |
| CO4 | Explore and evaluate the operation and applications of operational amplifiers. |
| CO5 | Understand the concept of Feedback and oscillator circuitry. |

## Instructional Method:

The course delivery method will depend on the requirements of the content and the needs of students. The teacher, in addition to the conventional teaching method by the blackboard, may also use any of the tools such as demonstration, role play, quizzes, brainstorming, MOOCs, etc.

From the content, 10% of topics are suggested for flipped mode instruction.

Students will utilize supplementary resources, including online videos, NPTEL/SWAYAM videos, e-courses, and Virtual Laboratories.

The internal evaluation will be done on the basis of the CCE-Continuous and Comprehensive Evaluation.

SEE: Semester End Evaluation will be conducted at the end of the semester for evaluation of the performance of students in the laboratory.

## Reference Books

[1] R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 11th ed. Boston, MA, USA: Pearson Education, 2013.

[2] A. P. Malvino and D. J. Bates, Electronic Principles, 7th ed. New York, NY, USA: McGraw-Hill, 2007.

[3] R. A. Gaikwad, Op-Amps and Linear Integrated Circuits, 4th ed. New Delhi, India: PHI Learning Pvt. Ltd., 2013.

[4] R. S. Sedha, A Textbook of Applied Electronics, 3rd ed. New Delhi, India: S. Chand & Co., 2014.

[5] H. S. Kalsi, Electronic Instrumentation, 3rd ed. New Delhi, India: Tata McGraw-Hill, 2010.