

Description of Course IRE 105

PART A: General Information

- 1 **Course Title** : Electronics Devices and Applications
- 2 **Type of Course** : THEORY
- 3 **Offered to** : DEPARTMENT OF IRE
- 4 **Pre-requisite Course(s)** : None

PART B: Course Details

1. Course Content (As approved by the Academic Council)

Conductor, Semiconductor, and Insulator: Basic concept of conductor, semiconductor, and insulator, energy band theory, fermi level, conduction in solid and insulator, types of semiconductors; P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified DC and AC diode models, dynamic resistance and capacitance; Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clipping and clamping circuits; Bipolar Junction Transistor (BJT) as a circuit element: BJT current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch. Single stage mid-band frequency; FET (Field Effect Transistor) AND MOSFET (Metal Oxide Field Effect Transistor): Concept of FET, Operating principle, differential and multistage amplifiers, low and high frequency model of FETs; The nature of MOSFET, operating principle of MOSFET, structure and physical operation of different types of depletion and enhancement MOSFET, introduction to CMOS; OPAMP (Operational Amplifier): Concept on OPAMP, properties of ideal Op-Amps, golden rule of OPAMP, inverting and non-inverting amplifiers, summing and subtractor amplifiers, integrator and differentiator, instrumentation amplifier, OPAMP comparator circuit; Power Electronics Systems: Power electronics system, Power electronics versus linear electronics, Power semiconductor devices (application perspective): Power diode, Power Transistor, Thyristor, SCR, DIAC, TRIAC, GTO, MOSFET, IGBT, SIT.

2. Course Objectives

The students are expected to:

1. To understand the basic knowledge of electronic devices like diode, Transistor, MOSFET etc. and its applications.
2. To become skilled at designing different electronic circuits like rectifier, amplifiers etc. using electronic devices.
3. To understand the operating characteristics of various power electronic elements.

3. Knowledge required

COURSE OUTLINE

Course No: IRE 105, Level 2/ Term 1, Credit (Contact) Hours: 3 Credits

Technical

- Introductory knowledge on basic electrical circuit is required.

Mathematics

- None

4. Course Outcomes (COs)

CO No.	CO Statement After undergoing this course, students should be able to:	Corresponding PO(s)*	Domains and Taxonomy level(s)**	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
CO1	Understand the basic operation of several electronic elements	PO(a)	C2	Lectures, Tutorials, Discussions	Written exams; presentation; assignment
CO2	Apply the knowledge of different electronic elements to solve real life engineering problems such as rectification, switch-ing and amplification.	PO(a), PO(c)	C3	Lectures, Tutorials, Discussions	Written exams; presentation; assignment
CO3	Analyze correctly the expected performance of various power electronics elements	PO(b)	C4	Lectures, Tutorials, Discussions	Written exams; presentation; assignment

*Program Outcomes (POs)

PO(a): Engineering knowledge; PO(b): Problem analysis; PO(c): Design/development of solutions; PO(d): Investigation; PO(e): Modern tool usage; PO(f): The engineer and society; PO(g): Environment and sustainability; PO(h): Ethics; PO(i): Individual work and teamwork; PO(j): Communication; PO(k): Project management and finance; PO(l): Life-long learning.

**Domains

C-Cognitive: C1: Knowledge; C2: Comprehension; C3: Application; C4: Analysis; C5: Synthesis; C6: Evaluation

A-Affective: A1: Receiving; A2: Responding; A3: Valuing; A4: Organizing; A5: Characterizing

P-Psychomotor: P1: Perception; P2: Set; P3: Guided Response; P4: Mechanism; P5: Complex Overt Response; P6: Adaptation; P7: Organization

5. Lecture/ Activity Plan

Week	Topic	Course Outcomes
1	Conductor, Semiconductor, and Insulator	CO1
2	P-N junction as a circuit element and diode circuits	CO1, CO2

3	Clipping and Clamping circuits	CO1, CO2
4	Zener diode, zener diode circuits and applications	CO1, CO2
5	Bipolar Junction Transistor (BJT) as a circuit element	CO1, CO2
6	FET (Field Effect Transistor)	CO1
7	MOSFET (Metal Oxide Field Effect Transistor)	CO1, CO3
8	OPAMP (Operational Amplifier)	CO1, CO2
9	OPAMP (Operational Amplifier)	CO1, CO2
10	Power Electronics Systems	CO2
11	Power diode, Power Transistor, Thyristor	CO2
12	SCR, DIAC,	CO2
13	TRIAC, GTO,	CO2
14	IGBT, SIT	CO2

6. Assessment Strategy

- Class Attendance: Class attendance will be recorded in every class.
- Continuous Assessments: Continuous Assessments (Class tests (5%), Assignments (5%), Quizzes (10%) and presentation (10%)) will be held during the semester as per the institutional ordinance.
 - i. Class Tests (15): Sudden class tests will be conducted to gauge the attentiveness of the students present in the class
 - ii. Assignments (15): The students will receive two assignments: one before to the midterm exam and another prior to the final exam.
 - iii. Quiz (30): 14 quizzes covering the material covered in the class lecture will be given using moodle. The total of all quiz scores will be adjusted on a scale from 0 to 30.
 - iv. Presentation (30): Every student have to give a presentation on a topic selected by his/her course teacher where their comprehension and breadth of knowledge on that subject will be evaluated.

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- Mid exam (72): A comprehensive mid exam will be held at the mid of the semester as per the institutional ordinance.
- Final exam (108): A comprehensive Final exam will be held at the end of the semester as per the institutional ordinance.

7. Distribution of Marks

Attendance:	10 %
Continuous Assessment:	30%
MID Exam:	24%
Final Exam:	36%
Total:	100%

8. Textbook/ Reference

- Fundamentals of Electric Circuits: Charles K. Alexander and Mathew N. O. Sadiku.
- A Textbook of Electrical Technology in S.I Units, Vol. 2: AC and DC Machines: B.L. Theraja and A.K. Theraja.
- Principles of Power Systems: V.K Mehta.
- Introductory Circuit Analysis: Robert L. Boylestad.
- A textbook of Electrical Technology: B. L. Theraja.
- Switchgear Protection & Power System (eco): Sunil S. Rao.

Course Teacher(s):

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Date of Preparation: Dec 27, 2023
Date of Approval by BUGS: