GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3134104
Semester – III
Subject Name: Electronic Devices and Circuits

Type of course: Engineering

Prerequisite: Zeal to learn the subject

Rationale: This course provides a platform for students to understand working of active devices such as Diode, BJT, and MOSFET, JFET and circuits and systems like amplifier, oscillator and feedback circuits. Students are also taught to analyze and design circuits using these active devices. This is one of the foundation courses which are required for students to understand working of complex electronic circuits and systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Semiconductors:** Conductors, Semiconductors, Silicon Crystal, Intrinsic Semiconductors, Two Types of Flow, Doping a Semiconductor, Two Types of Extrinsic Semiconductors, The Unbiased Diode, Forward Bias, Reverse Bias, Breakdown, Energy Levels, The energy Hill, The Barrier Potential and Temperature, Reverse-Biased Diode	02
2	**Diode Theory:** Basic Ideas, The Ideal Diode, The Second Approximation, The Third Approximation, Reading a Data Sheet, How to Calculate Bulk Resistance, DC Resistance of a Diode , Load Lines	03
3	**Diode Circuits:** The Half Wave Rectifier, The Transformer, The full Wave Rectifier, The Bridge Rectifier, The Choke – Input Filter, The Capacitor – Input Filter, Peak, Inverse Voltage and Surge Current, Clipper and Limiters, Clampers, Voltage Multipliers	05
4	**Special Purpose Diode:** The Zener Diode, The Loaded Zener Regulator, Second Approximation of a Zener Diode, Zener Drop Out Point, Reading a Data Sheet, Load Lines, Optoelectronics Devices, The Schottky Diode, The Varactor, Other Diodes	04
5	**Bipolar Junction Transistor**: The Unbiased Transistor, The Biased Transistor, Transistor Currents, The CE Connection, The base Curve, Collector Curves, Transistor Approximations, Reading Data Sheets	04

6	**Transistor Fundamentals:** Variation in Current gain, The Load Line, The Operating Point, Recognizing saturation, The Transistor Switch, Emitter Bias, LED Drivers, The effect of small Changes, More Optoelectronics Devices	**04**
7	**Transistor Biasing:** Voltage Divide Bias, Accurate Voltage Divide Bias (VDB) Analysis, VDB Load line and Q-Point, Two Supply Emitter Bias, Other Types of Bias, PNP Transistors	**05**
8	**AC Models:** Base-Biased Amplifier, Emitter-Biased Amplifier, Small-Signal operation, AC Beta, AC Resistance of the Emitter Diode, Two Transistor models, Analyzing an Amplifier, AC Quantities on the data sheet	**04**
9	**Voltage amplifier:** Voltage gain, The loading effect of input impedance, multistage amplifiers, swamped amplifier, two-stage feedback **Frequency Effects:** Frequency Response of an Amplifier, Decibel Power gain, Decibel voltage gain, Impedance matching, The Miller Effect	**05**
10	**CC and CB Amplifier:** CC Amplifier, Output Impedance, Cascading CE and CC, Darlington Connections, Voltage Regulation, The Common Base Amplifier	**04**
11	**Power Amplifiers:** Amplifier Terms, Two Load Lines, Class-A Operation, Class-B Operation, Class-B Push Pull Emitter Follower, Biasing Class B/AB Amplifiers, Class B/AB Driver, Class-C Operation	**04**
12	**JFETs AND MOSFETs:** Basic Ideas, Drain Curves, Transconductance Curves, Biasing in Ohmic Region, Biasing in Active Region, Transconductance, JFET Amplifiers, JFET Analog Switch, Other JFET Applications, The Depletion Mode MOSFET, D-MOSFET Curves, Depletion Mode MOSFET Amplifier, The Enhancement Mode MOSFET	**04**
13	**Feedback Amplifier:** Introduction, The Basic concepts of Feedback, Effect of Negative Feedback, Types of Negative Feedback Connections, Method of Identifying Feedback Topology and Feedback Factor, Stability of Feedback Amplifier	**04**

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	**30**	**15**	**5**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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

Reference Books:

1. Electronics Principles by Albert Malvino [seventh Edition]
2. Electronics Device and circuits by S Salivahanan and N Suresh Kumar, McGraw Hill Publication [Second Edition or Higher Edition].
3. Electronics Device and circuits by Jacob Milman and Christos C. Halkias, Tata Macgraw Hill Publication [Second Edition].
4. Basic Electronics devices and Circuits by Mahesh B Patil, PHI Learning PVT. Ltd.

Course Outcomes:

After completion of the course, the student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Apply the principles of various electronics devices for building small projects.	40
CO-2	Understand the concepts of different amplifiers.	30
CO-3	Justify the need of diodes and transistors in semiconductor industries.	30

List of Experiments:

1 Obtain I-V characteristic of Diode.
2 To measure ripple factor at the output of (a) Half wave rectifier with and without filter capacitor (b) Full Wave rectifier with and without filter capacitor (C) Bridge rectifier with and without filter capacitor.
3 To verify performance of various Clipper circuits.
4 To verify performance of various Clamper circuits.
5 Obtain I-V characteristic of Zener Diode.
6 Obtain I-V characteristic of photo diode.
7 To obtain characteristic of transistor as a switch circuit.
8 To obtain input and output characteristics and calculate gain of CE amplifier circuit.
9 To obtain input and output characteristics and calculate gain of CB amplifier circuit.
10 To obtain frequency response of single stage transistor amplifier.
11 To obtain the transfer characteristics of FET.
12 To test the performance of negative feedback amplifier and compare gain, BW with amplifier without feedback.
13 To study the effect of (a) voltage series feedback on two stage amplifier (b) current series F/B on single stage CE amplifier.
14 Determine the efficiency of push pull power amplifier
15 Build/test transformer coupled class-A Power amplifier.

Major Equipment:

C.R.O., Function Generator, Power Supply, Multimeter, Digital Storage Oscilloscope, Experimental Trainer Kits, Bread Board, General Purpose PCB

List of Open Source Software/learning website:

NPTEL