

GUJARAT TECHNOLOGICAL UNIVERSITY

BASIC ELECTRONICS SUBJECT CODE: 2110006 B.E. 1st YEAR

Type of course: Basic

Prerequisite: N.A.

Rationale: Electronics devices such as diodes, BJTs, and FETs are very basic building blocks of many systems used.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
4	0	2	6	70	30*	30	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Content:

Sr #	Topic	Teaching Hrs.	Module Weightage
1	Introduction <ul style="list-style-type: none">• Three kinds of formulas• Approximations• Voltage Sources• Current Sources• Thevenin's Theorem• Norton's Theorem	3	08
2	Semiconductors: <ul style="list-style-type: none">• Conductors• Semiconductors• Silicon Crystal• Intrinsic Semiconductors• Two types of flow• Doping a Semiconductor• Two types of Extrinsic Semiconductors• The Unbiased Diode• Forward Biased• Reverse Biased• Breakdown• Energy levels• Energy hill• Barrier Potential and Temperature• Reverse Biased Diode	4	08

3	Diode Theory <ul style="list-style-type: none"> • Basic ideas • The Ideal diode • The Second approximation • The Third approximation • Up-down circuit analysis • Reading a datasheet • How to calculate Bulk resistance • DC Resistance of diode • Load lines • Surface-Mount diodes 	5	10
4	Diode Circuits: <ul style="list-style-type: none"> • 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 • Commercial Transformers, Fuse currents. • Clippers and limiters • Clampers • Voltage Multipliers 	5	15
5	Special-Purpose Diodes: <ul style="list-style-type: none"> • The Zener diode • The loaded Zener Regulator • Second Approximation of Zener Diode • Zener drop-out point • Reading a Data Sheet • Troubleshooting • Load Lines • Optoelectronic Devices • The Schottky Diode • The Varactor • Other Diodes 	6	15
6	Bipolar Junction Transistor <ul style="list-style-type: none"> • The Unbiased Transistor • The Biased Transistor • Transistor currents • The CE connections • The Base Curve • Collector Curves • Transistor Approximations • Reading Data Sheets • Surface-Mount Transistors 	8	14
7	Transistor Fundamentals <ul style="list-style-type: none"> • Variations in current gain 	8	15

	<ul style="list-style-type: none"> • The load line • The Operating point • Recognizing Saturation • The Transistor Switch • Emitter Bias • LED Drivers • The Effect of small changes • Photo Transistors, optocoupler 		
8	Transistor Biasing <ul style="list-style-type: none"> • Voltage –divider Bias • Accurate VDB Analysis • VDB Load Line and Q point • Two-Supply emitter bias • Other types of Bias • Troubleshooting • PNP Transistors 	8	15

Reference Books:

1. Electronic Principles, Albert Malvino and David J Bates, Mc Graw Hill(7th Edition)
2. Electronic Devices, Thomas L. Floyd, Pearson (7th Edition)
3. Electronic Devices and Circuits, David A. Bell, Oxford Press (5th Edition)
4. Integrated Electronics, Jacob Millman, Christos Halkias & Chetan D. Parikh, Tata McGraw Hill (2nd Edition)

Course Outcome:

After completion of the course Student will be able to –

1. Understand the basics of electronics, electronic components, and their characteristics
2. Analyze circuits with diodes, Bi-polar Junction Transistors (BJTs), and Field Effect Transistor (FETs).
3. Read and interpret the data sheet of basic electronics component.
4. Understand the process of troubleshooting the electronic components.

List of Experiments:

1. To observe sine, square, and triangular waveforms on the C.R.O. and measure amplitude and frequency of the waveforms.
2. To understand the concept of Voltage source and current source.
3. To verify and check Thevenin's Theorem
4. To verify and check Norton's Theorem
5. To study about Intrinsic and Extrinsic Semiconductor
6. To Study and perform forward and reverse bias characteristic of Diode.
7. To Measure Ripple Factor at the output of half wave rectifier with and without filter capacitor
8. To Measure Ripple Factor at the output of full Wave rectifier with and without filter capacitor.
9. To verify and check the performance of Various Clipper circuits
10. To verify and check the performance of Various Clamper circuits
11. To obtain V-I Characteristic of Zener Diode
12. To observe the characteristics of light emitting diode (LED)

13. To observe the characteristics of semiconductor photo diode
14. To verify the working of transistor as a switch. (Draw DC load line for given circuit)
15. To plot input-output Characteristic of common emitter (CE) amplifier. (Measure gain of amplifier at different frequencies and plot frequency response). Also plot the load line superimposed on the I/O characteristics.
16. To plot input-output Characteristic of common emitter (CB / CC) amplifier. (Measure gain of amplifier at different frequencies and plot frequency response). Also plot the load line superimposed on the I/O characteristics.
17. To understand the concept of various Biasing techniques with example

Suggested List of Student Activities

- Prepare the working charts about various components, referring learning resources available in institute library.
- Identify electronics components, not listed in the curricula and study their characteristics.
- Get any one electronic circuit from Faculty member, Build it and check the results.

Major Equipment's:

- (1) CRO (At least 20MHz)
- (2) Function Generator (Frequency range up to 20 MHz) – need to have sine, square wave output.
- (3) Dual Power Supply (0-12V/15V DC)/3A
- (4) Micrometers for measurement of voltage and current with suitable ranges.
- (5) Multimeter
- (6) Various Electronics Components i.e Diode, Zener Diode, Transistor, LED, Photo diode, Resistors, capacitor etc.

List of Open Source Software/learning website:

Software: (1) MULTISIM
(2) ORCAD
(3) ngspice

Learning Material: <http://nptel.iitm.ac.in/>

*PA (M): 10 marks for Active Learning Assignments, 20 mark for other methods of PA

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus of Basic Electronics is covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be sent to achievements@gtu.edu.in.