



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3132003

Semester – III

Subject Name: Design Concepts in Basic Electronics

Type of course: Engineering

Prerequisite: Zeal to learn the subject

Rationale: This subject can be considered to be a stepping stone to Computer Architecture. It involves Basics of electronics for hardware understanding.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Number system and codes Binary, Octal, Hexadecimal and Decimal Number systems and their inter conversion BCD numbers (8421-2421), Gray Code, Excess-3 Code, Cyclic Code, Code Conversion, ASCII, EBCDIC codes. Binary Addition and Subtraction, Signed and Unsigned binary numbers, 1's and 2's Complement Representation.	03
2	Boolean Algebra: Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR and their truth tables), Universal Gates. Laws of Boolean algebra, De-Morgan's theorem, Min term, Max term, POS, SOP. Karnaugh Map, Simplification by Boolean theorems, don't care condition.	03
3	Combinational Logic: The Half Adder, the Full Adder, Subtractor circuit. Multiplexer De-multiplexer, Decoder, BCD to Seven segment decoder, encoders. Flip flop and Timing circuit: Set-Reset latches, D-flip flop, R-S flip-flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop.	06
4	Registers & Counters: Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter. Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register.	05
5	Logic Families: Introduction to digital logic family such as RTL, DTL, TTL, ECL, CMOS, IIR, HTL etc.	03



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	their comparative study Basic circuit, performance characteristics, Wired logic, open collector output etc.	
6	Diode Theory Conductors and Semiconductors, Silicon Crystal, Intrinsic Semiconductors, Extrinsic Semiconductors, The Ideal diode, Reading a datasheet. DC Resistance of diode, The Unbiased Diode- Forward Biased and Reverse Biased, Breakdown Energy levels, Barrier Potential and Temperature, Load lines, Surface-Mount diodes.	03
7	Diode Circuits: The Half-Wave rectifier, Full-Wave rectifier, Choke-input filter, Capacitor-input filter, Peak Inverse Voltage, Clippers and limiters, Clampers, Voltage Multipliers	04
8	Bipolar Junction Transistor The Unbiased Transistor, The Biased Transistor, transistor currents, CE connections, Base and Collector Curves. Transistor Approximations, Reading Data Sheets, Surface-Mount Transistors Variations in current gain, the load line, the Operating point, recognizing Saturation, the Transistor Switch	07
9	Transistor Biasing Voltage – divider Bias, Accurate Analysis, Load Line and Q point, Fixed Bias, Self Bias, Emitter Bias.	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
35	35	10	10	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. Digital Fundamentals by Morris and Mano, PHI Publication
2. Fundamental of digital circuits by A.ANANDKUMAR, PHI Publication
3. Basic Electronics And Linear Circuits by N. N. Bhargava D. C. Kulshreshtha S. C. Gupta Tata McGraw - Hill Education publication.
4. Electronic Devices and Circuit Theory by Robert Boylested, Louis Nashelsky, PHI publication.



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Course Outcomes:

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

Sr. No.	CO statement	Marks % weightage
CO-1	Design different real time application based combinational circuits.	20
CO-2	Design counters, shift registers of desired sequences and Identify load line for different biasing techniques using hardware and software.	30
CO-3	Design diode based and transistor based circuits for mini projects used in automation.	30
CO-4	Identify different number systems and it's inter conversions.	20

List of Experiments:

Following is the list of experiments for reference. Student should perform at least 10 experiments out of the 14.

Sr. No.	Practical/Exercise
1	To study the operation of the logic gates: AND, OR, NOT, NAND, NOR and X-OR. To study NAND and NOR as universal gates.
2	Reduce the Boolean Expressions to its simplest possible form. Implement it using gates & K-maps.
3	Construct Half Adder, Full Adder, Half Subtractor & Full Subtractor. Verify the truth-table for each
4	Design 4-bit up and down counter using Master Slave JK Flip-flops.
5	Design 4-bit synchronous counter using Master Slave JK Flip-flops.
6	To study V-I characteristics of (a) PN Junction Diode (b) Zener Diode (c) LED
7	To study Half Wave Rectifier and Full Wave Rectifier.
8	To study L Filter and C Filter and calculation of related parameters.
9	To study Clipper circuits using PN Junction Diode.
10	To study Clamper circuits using PN Junction Diode.
11	To study transistor datasheets
12	To study Input and Output Characteristics of CB configuration of Transistor.
13	To study Input and Output Characteristics of CE configuration of Transistor.
14	To study self-bias circuit of CE configuration.



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Major Equipment:

- (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) Multimeters for measurement of voltage and current with suitable ranges.
- (5) Various Electronics Components including different types of diodes, transistors and digital ICs.

List of Open Source Software/learning website:

NPTEL