

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT
COURSE CURRICULUM

Course Title: Fundamental of Digital Electronics
(Code: 3310702)

Diploma Programmes in which this course is offered	Semester in which offered
Computer Engineering, Information Technology,	First Semester
Biomedical Engineering	Second Semester

1. RATIONALE

The objective of Fundamental of Digital Electronics is to make the students understand functioning of a digital circuit. The course contains description of digital components using core structure of digital logic. This includes number system, Logic gates, Boolean algebra, Combinational logic. This Course will enable student to solve various Boolean expressions, to design and implement digital logic circuits.

2. LIST OF COMPETENCIES

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies.

- Design sequential and combinational circuits of any electronic device.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit;
ESE – End Semester Examination; PA - Progressive Assessment.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – 1: Binary Systems	1.1.Comprehend Number systems and binary codes 1.2.Convert Number systems and its complements	Binary Systems <ul style="list-style-type: none"> ➤ Introduction of Digital Computers and Digital Systems ➤ Binary Numbers ➤ Base Conversion <ul style="list-style-type: none"> •BINARY •DECIMAL •HEX •OCTAL ➤ Complements <ul style="list-style-type: none"> •R's Complement •2' and 10's Complement •(R-1)'s Complement •1's and 9's Complement ➤ Binary Codes <ul style="list-style-type: none"> •Decimal Codes •Error Detection codes •Reflected Code
Unit– 2: Binary Logic And Boolean Algebra	2.1.Explain Binary Logic 2.2.List and explain working of Logic Gates 2.3.Solve Boolean algebra 2.4.Define and solve various Boolean theorems 2.5.Solve Boolean expression	Binary Logic And Boolean Algebra <ul style="list-style-type: none"> ➤ Basic Binary logic ➤ Logic Gates <ul style="list-style-type: none"> •AND , OR, INVERTER ➤ Postulates ➤ Boolean algebra <ul style="list-style-type: none"> •Two value Boolean algebra ➤ Basic theorems of Boolean algebra ➤ De-Morgan's Theorems ➤ Boolean functions ➤ Boolean forms <ul style="list-style-type: none"> •Canonical •Standard
Unit– 3: Boolean Function Implementation	3.1 Explain Boolean function Implementation and simplification	Boolean Function Implementation <ul style="list-style-type: none"> ➤ Need for simplification ➤ K – Map method <ul style="list-style-type: none"> •2 – Variable K – map •3 – Variable K – map •4 – variable K – map ➤ K – Map using Don't care condition ➤ Universal Gates <ul style="list-style-type: none"> •NAND Gate •NOR Gate ➤ NAND Implementation ➤ NOR Implementation

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit– 4: Basic Combinational Logic	4.1 Explain Basic Combinational Logic 4.2 Design half adder, full adder, Half Subtractor & full Subtractor 4.3 Explain multiplexer and demultiplexers	Basic Combinational Logic ➤ Design procedure of combinational logic ➤ Adder • Half Adder • Full Adder ➤ Subtractor • Half Subtractor • Full Subtractor ➤ Code Conversion • BCD – Excess-3 conversion
Unit– 5: Combinational Logic Using MSI And LSI	5.1 Design MSI Combinational Logic & LSI 5.1 Implement combination logic circuit using mux and Dmux	Combinational Logic Using MSI And LSI ➤ Binary Parallel Adder ➤ Magnitude Comparator • 2 Input Comparator ➤ Decoder • 2 – 4 Decoder • 3 – 8 Decoder ➤ Encoder • 4 – 2 Encoder • 8 – 3 Encoder ➤ Multiplexer • 4 – 1 multiplexer ➤ Demultiplexers • 1 – 4 Demultiplexers

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Binary Systems	06	2	4	4	10
2.	Binary Logic and Boolean algebra	08	2	4	6	12
3.	Boolean function Implementation	08	4	4	6	14
4.	Basic Combinational Logic	10	4	6	6	16
5.	Combinational Logic Using MSI and LSI	10	4	6	8	18
	Total	42	16	24	30	70

Legends:

R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

6. SUGGESTED LIST OF PRACTICALS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency .

S. No.	Unit No.	Practical's
1	1	Convert Number system to another (HEX ,OCTAL,DECIMAL,BINARY)
2	1	Calculate R's and (R-1)'s Complements
3	2	Realize the basic logic gates.
4	2	Realize the NAND gate as a universal building block.
5	2	Realize the NOR gate as a universal building block.
6	3	Simplify and design Boolean expression using basic logic gates
7	3	Simplify and design Boolean expression using Universal gates
8	4	Design and implement Half Adder and full adder circuit.
9	4	Design and implement Half Subtractor and full Subtractor circuit.
10	5	Realize the Binary Parallel Adder circuit
11	5	Realize Multiplexer and Demultiplexer circuit
12	5	Realize Decoder and Encoder circuit

7. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.

8. SUGGESTED LEARNING RESOURCES

A. List of Books

S.No.	Author	Title of Books	Publication
1	Mano M. Morris	Digital logic and Computer Design	Pearson publication, Latest Edition ISBN: 81-203-0417-9
2	Jain R.P.	Modern Digital Electronics	Tata McGraw-Hills publication, Latest Edition
3	Malvino & Leech	Digital electronics Principles	Tata McGraw-Hills publication, Latest Edition
4	Anand Kumar	Fundamentals of Digital Circuits	Prentice-Hall of India, Latest Edition

B. List of Major Equipment/ Instrument

- i). Binary to Decimal Converter & Decimal to Binary Converter
- ii). Binary to Gray code Converter & Gray to Binary code Converter
- iii).BCD to Seven Segment Decoder (Common Cathode Display)
- iv).Basic Logic Gates using Diode & Transistor
- v). AND, OR, NOT Gate Characteristics kit
- vi). OR,NOR,EX-OR Gate Characteristics kit
- vii).De-Morgan's Theorem kit
- viii).NAND & NOR as Universal Gate
- ix).Flip-Flop Trainer (D, T, JK, MS Types)

- x). Multiplexer / De-multiplexer using Gates
- xi). Half & Full Adder
- xii). Half & Full Subtractor
- xiii). A To D Converter using Successive Approximation Method / D to A Converter using Binary Weighed Method (4 bit)
- xiv). Parity Generator / Even & Odd parity Checker
- xv). Bread Board Trainer (For Digital IC's)

C. List of Software/Learning Websites

- i). Digital Electronics Tutorial
- ii). <http://www.asic-world.com/digital/tutorial.html>

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- i) M.P.PARMAR, Incharge Head and Senior Lecturer, Information Technology Department, Government Polytechnic, Ahmedabad
- ii) M.D.PATEL, Incharge Head and Senior Lecturer, Information Technology Department Dr. S. S. Gandhi College Surat.

Co-ordinator and Faculty Member from NITTTR Bhopal

- i). Dr. Shailendra Singh, Professor, Dept. of Computer Engineering & Application, NITTTR, Shamla Hills, Bhopal
- ii). Dr. K. James Mathai, Associate Professor, Dept. of Computer Engineering & Application, NITTTR, Shamla Hills, Bhopal