PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Course Code				**23ELMAL231**			
Title of the Course				**Digital Electronics**			
Offered to: (Programme/s)				**B.Sc(H)-Electronics**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**3**
Year of Introduction:	**2024-25**			**Semester:3**			**3**
Course Category:	**Major**			**Course Relates to:**	**Global**		
Year of Revision:	**N/A**			**Percentage:**	**N/A**		
Type of the Course:				**Employability**			
Crosscutting Issues of the Course :				Professional Ethics			
Pre-requisites, if any				**Basic Electronics**			

Course Description:

This course provides a comprehensive introduction to the principles and applications of digital electronics. It covers the fundamental concepts and techniques used in the design and analysis of digital systems. Students will explore binary systems, Boolean algebra, logic gates, combinational and sequential logic circuits, and digital integrated circuits. Emphasis is placed on both theoretical understanding and practical skills, with hands-on lab sessions to reinforce concepts.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	Understand the basic concepts of digital electronics and its importance in modern technology.
2	Learn to design and analyze combinational and sequential logic circuits.
3	Gain proficiency in using Boolean algebra for simplifying and implementing digital circuits.
4	Develop skills in using digital simulation tools for circuit design and troubleshooting.
5	Understand the operation and application of digital integrated circuits.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Remember the binary number theory of digital circuits	**K1**	**1**	**1**
CO2	Design combinational systems using standard gates and minimization methods (such as karnaugh maps).	**K4**	**1**	**1**
CO3	Apply design various logical inputs of different IC- logic families	**K3**	**1**	**1**
CO4	Design flip-flops and latches for sequential systems composed of standard sequential modules, such as counters and registers	**K4**	**1**	**1**
CO5	Analyze combinational systems composed of standard combinational modules, such as multiplexers and decoders .	**K4**	**1**	**1**

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1	**2**							**2**	
CO2	**3**							**3**	
CO3	**3**							**3**	
CO4	**2**							**2**	
CO5	**2**							**2**	

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1 :NUMBER SYSTEM AND CODES (12Hrs)

Decimal, Binary, Hexadecimal, Octal, Code Conversions, Complements (1‘s,2‘s, 9‘s and10‘s), Addition, Subtraction, Grey, Excess-3, inter Code conversion between number system.

Examples/Applications/Case Studies:

- A 4-bit binary number can represent values from 0 to 15, which can be used to control digital switches or memory locations.

- The decimal number 27 is represented in BCD as 0010 0111 (where 0010 is 2 and 0111 is 7).

Exercises/Projects:

- Perform 1's and 2's compliment for this number 1100
- Convert the number 1101 in to gray code.

Specific Resources: (web)

URL:

https://byjus.com/maths/number-system/

Unit – 2 :BOOLEAN ALGEBRA AND THEOREMS (12Hrs)

Boolean Theorems, De Morgan's laws. Digital logic gates, Multilevel NAND &NORgates. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh Map Method: 4 variables), don't care condition.

Examples/Applications/Case Studies:

- Simplifying Boolean Expressions $A \cdot (A+B)$.
- Simplifying Complex Expressions $A \cdot \bar{A} + B \cdot \bar{B} A$

Exercises/Projects:

- simplify the Boolean expression using Demorgan laws
- simplify 4-variable using k-map method $\sum=(0,2,4,6.11.12.13)$

Specific Resources: (web)

URL:

https://www.geeksforgeeks.org/boolean-algebraic-theorems/

Unit – 3 :IC LOGIC FAMILIES: (12Hrs)

Digital Logic Families: Characteristics of logic families – fan in, fan out, power dissipation, propagation delay, noise margin., RTL, DTL,TTL and CMOS logic circuits- Inverter, NAND , NOR

Examples/Applications/Case Studies:

- TRANSISTOR TRANSISTOR LOGIC FAMILY.
- CMOS LOGIC

Exercises/Projects:

- Identify Logic Family Characteristics
- Determine the Logic Family Based on IC Numbers

- **Specific Resources: (web)**

URL:

https://evelta.com/categories/integrated-circuits-ics/logic-ics/?page=2

Unit – 4: COMBINATIONAL DIGITAL CIRCUITS (12Hrs)

Adders: Half & full adder, Subtractor – Half and Full Subtractor, Parallel binary adder, Magnitude Comparator, Multiplexers (2:1, 4:1)) and De-multiplexers (1:2, 4:1), Encoder (8- line-to-3-line) and Decoder (3-line-to-8-line).

Examples/Applications/Case Studies:

- Design 8:1 multiplexer
- Design 4:16 Decoder

Exercises/Projects:

- Design Half adder
- Design full adder using two half adders.

Specific Resources: (web)

URL:

https://circuitverse.org/

Unit – 5 :SEQUENTIAL DIGITAL CIRCUITS (12Hrs)

Flip -Flops: S-RFF,J-KFF,T and D type FFs, Excitation tables. Registers: shift left register, shift right register, Counters:-Asynchronous-Mod16, Mod-8 Down counter. Synchronous- 4-bit Ring counter

Examples/Applications/Case Studies:

- Count Occurrences of events or pulses.
- Measure the frequency of signals.

Exercises/Projects:

- Design a shift left register using D-flip-flop
- Design a down counter using j-k flip-flop.

Specific Resources: (web)

URL:

https://www.javatpoint.com/sequential-circuits-in-digital-electronics

Text Books:

1. W.H. Gothmann, 2000, “Digital Electronics - An Introduction, Theory and Practice”, 2nd Edition Prentice Hall of India.

2. M.MorrisMano, 2003, “DigitalDesign”,4thEdition, Pearson Education (Singapore) Pvt. Ltd. New Delhi.

References:

1. A.AnandKumar, (2003) *“Switching Theory and LogicDesign*”–2ndEdition,PHI.

2. HeiserMan, (2002) *“Handbook of Digital IC applications”*2nd Edition, PrenticeHall..

3. T.L. Floyd & Jain,(2010) *“Digital Fundamentals”,*10th Edition, Pearson.

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Model Question Paper

TITLE: DIGITAL ELECTRONICS

Course Code: 23ELMAL231 **Maximum Marks: 70M**

Time: 3 Hours **Pass Minimum: 28M**

SECTION – A

Answer any FIVE of the following: **5 x 4 = 20 M**

1. (a)Write about Excess-3 code with example **k1**

(or)

(b)Convert the following decimal number (245) in to binary. **K1**

2. (a)Explain about universal gates **k2**

(or)

(b)Explain about multilevel NAND gate **.k2**

3. (a) Write about the characteristics of logic families. **K3**

(or)

(b) Explain about ECL logic family**.k3**

4. (a) Discuss about magnitude comparator in brief. **K2**

(or)

(b)Explain about decoder and encoder with one example each. **K2**

5. a)Explain the construction and working of D-Flip-flop.**k3**

(or)

b)Discuss about Shift registers in brief. **K3**

Section – B

Answer the following: **5 x 10 = 50 M**

6.(a)Explain about rules of 1's compliment and 2's compliment method.k2

(or)

(b) Convert the following grey code to binary vice-versa.k2

(1)11101 (2)100110—**(co1)-(L2)**

7.(a)Explain briefly about canonical and standard form of Boolean algebra.**k2**

(or)

(b)Simplify the following functions in sum of products using K-map and draw their implementation.

(i)F (A, B, C, D) =∑ (7, 13, 14, 15)
(ii)F(w,x,y,z)=∑(1,3,7,11,15)+d∑(0,2,5) **k2**

8. (a) Discuss briefly about CMOS NOR gate with their truth tables. **K3**

(or)

(b)Discuss about the construction and working of TTL NAND gate and Characteristics.k3

9.a)Explain the construction and working of HALF adder and FULL adder with their logic circuits. **K2**

(or)

b)Explain the construction and working of HALF sub tractor and FULL sub tractor with their logic circuits. **K2**

10.(a) Explain the operation of JK-Flip-flop and draw the timing diagram.k3

(or)

(b) Define counter and Explain briefly about ripple counter.k3

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