**4.4 DIGITAL ELECTRONICS**

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**4 - 3**

**RATIONALE**

Digital electronics has made extremely rapid advances in the last five decades. It has important applications in communication entertainment, instrumentation, control, automation etc. Thus it appears that there is no end to its usefulness. In fact, the light and the new world belongs to it. So it is necessary to give the knowledge of digital electronics to the electrical students. Microprocessor is one of the most exciting technological advancement among the semiconductor devices in recent times. It has a tremendous impact on the Industrial processes due to its high reliability, flexibility and control capacity both at the design and the Implementation stages. The decreasing cost with increasing facilities act as catalysts in widening their scope of applications.

**LEARNING OUTCOMES**

After undergoing the subject, students will be able to:

* Add, multiply, subtract binary to hexadecimal number system
* Use 1’s and 2’s compliment method for addition and substraction
* Draw the symbols of various gates and write the truth tables for those gates
* Use boolean laws for the simplification of logical expressions
* Use the de-morgan’s theorem for simplification
* Apply K-map technique for simplifications
* Apply half adder, full adder, encoder, decoder, multiplexer and demultiplexer
* Use various flip-flops in digital circuits
* Use converted from A/D and D/A conversions
* Use various types of numbers in digital circuits

##### DETAILED CONTENTS

##### (Part-A)

1. Number Systems (10 Periods)

* 1. Decimal, binary, octal and hexa-decimal number systems and their inter-conversion
  2. Binary and Hexadecimal addition, subtraction and multiplication
  3. 1’s and 2’s complement methods of addition/subtraction

2. Gates (07 Periods)

Definition, symbol and truth tables for inverter, OR, AND, NAND, NOR and X-OR and equivalence circuit (Ex.NOR)

3. Boolean Algebra (10 Periods)

* 1. Boolean Relations and their applications
  2. DeMorgan’s Theorems
  3. K-Map upto four variables

4. Combinational Circuits (10 Periods)

* 1. Half adder, Full adder
  2. Encoder, Decoder
  3. Multiplexer/Demultiplexer
  4. Display Devices (LED, LCD and 7-segment display)

5. Flip-Flops (08 Periods)

* 1. J-K Flip-Flop
  2. R-S Flip-Flop
  3. D-Type Flip-Flop
  4. T-Type Flip-Flop
  5. Applications of Flip-Flops

6. Introduction of Shift Registers and Counters (08Periods)

7. A/D and D/A Converters (06 Periods)

7.1 A/D converter (Counter ramp, successive approximation method of A/D Conversion)

7.2 D/A converters (Binary weighted, R-2R D/A Converter)

8. Semi-conductor Memories (05 Periods)

Types, merits, demerits, and applications

#### LIST OF PRACTICALS

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, X-OR gates

2. Construction of Half Adder using gates

3. Construction of Full Adder using gates

4. To verify the truth table for JK flipflop

5. Construction and testing of any counter

6. Verification of operation of a 8-bit D/A Converter

#### INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A converters and other Topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. More emphasis while teaching this subject should be given on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini projects based on microprocessor operations may be identified and given to students as assignments.

**MEANS OF ASSESSMENT**

* Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

#### Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

#### RECOMMENDED BOOKS

1. Modern Digital Electronics by RP Jain, Tata McGraw Hill, Education Pvt. Ltd. New Delhi
2. Digital Principles and Electronics by Malvino and Leach, Tata McGraw Hill, New Delhi
3. Digital Electronics by Rajiv Sapra, Eshan Publications, Ambala City
4. Digital Fundamentals by Floyd and Jain , Pearsons Education (Singapore) Pte Ltd Patparganj, Delhi 110092
5. Digital Electronics by Jamwal, Dhanpat Rai and Co. New Delhi
6. Microprocessors Architecture, Programming and Application with 8085/8080A, Ramesh S Gaonkar, Wiley Eastern Ltd. New Delhi
7. Introduction to Microporcessors by Aditya Mathur, TMH Publishing Co., New Delhi
8. Microprocessors and Microcontrollers by BP Singh, Galgotia Publications, New Delhi
9. Digital Systems by Sanjay K Bose, Wiley Eatern(P) Ltd. New Delhi
10. Digital Systems : principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
11. Digital Integrated Circuits by AK Gautam, SK Kataria and Sons, New Delhi
12. Microprocessors(The 8086 and 8088) by AK Gautam and A Jaiswal; SK Kataria and Sons, New Delhi
13. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

**SUGGESTED DISTRIBUTION OF MARKS**

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| --- | --- | --- |
| **Topic No.** | **Time Allotted (Periods)** | **Marks Allotted (%)** |
|  | 10 | 16 |
|  | 07 | 10 |
|  | 10 | 16 |
|  | 10 | 16 |
|  | 08 | 12 |
|  | 08 | 12 |
|  | 06 | 10 |
|  | 05 | 08 |
| **Total** | **64** | **100** |