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|---|---|---|
| **Programme** | **:** | **Diploma in ET**/CE/EE//ME/MT/CM/IT/DDGM |
| **Programme Code** | **:** | 01/02/**03**/04/05/06/07/08/21/22/**23**/24/26/16/**17** |
| **Name of Course** | **:** | **Digital Electronics** |
| **Course Code** | **:** | **ET 388** |

**Teaching Scheme:**

| | **Hours /Week** | **Total Hours** |
|---|---|---|
| **Theory** | **03** | **48** |
| **Practical** | **02** | **32** |

**Evaluation Scheme:**

| | **Progressive Assessment** | **Semester End Examination** | | | |
|---|---|---|---|---|---|
| | | **Theory** | **Practical** | **Oral** | **Term work** |
| **Duration** | **Two class tests, each of 60 minutes** | **3 Hrs.** | **3 Hrs.** | **3 Hrs. For batch of 20 students** | **--** |
| **Marks** | **20** | **80** | **25** | **---** | 25 |

**Course Rationale:**

This subject forms the foundation of digital electronic systems. It is essential to know these fundamentals to understand the concept of microprocessors & its applications.

**Course Objectives:**

After studying this course, the student will be able to

- Know the Concept of Digital system.
- Understand the operations of fundamental digital circuits.
- Simplify logic circuits using Boolean algebra
- Construct simple logic circuits.
- Understand and implement the operations of combinational and sequential circuit.
- Understand the functions of various ICs of data converters and memories.

**Course Content:**

| Chapter No. | Name of Topic/Sub topic | Hrs | Marks |
|---|---|---|---|
| **1.** | **Number system** | | |
| | **1.1 Introduction to digital system**<br>• Analog signal Vs Digital signal<br>• Number systems (Decimal, binary, octal, hexadecimal) conversion of one system into other<br>**1.2 Binary Arithmetic**: - ( Numerical )<br>• Addition,<br>• Subtraction( 1's and 2's complement)<br>• Multiplication<br>• Division<br>• BCD addition and subtraction using 9's and 10' complement<br>**1.3 Codes:**<br>• BCD<br>• Grey<br>• EX-3<br>• ASCII | **08** | **14** |
| **2.** | **Logic families and gates** | | |
| | **2.1 Logic families such as TTL, CMOS.**<br>• Characteristics of logic families & Comparison between different logic families<br>• TTL NAND gate – Totem pole output<br>• CMOS Inverter<br>**2.2 Logic Gates**<br>• Basic gates and Derived gates (IC diagram)<br>• NAND and NOR as Universal gates<br>• Fundamentals of Boolean laws (Numerical)<br>• Duality Theorem, De Morgan's theorems.(Numerical) | **06** | **12** |
| **3.** | **Combinational Logic Circuits** | | |
| | **3.1 K-map reduction techniques** (up to 4 variable maps) using SOP & POS Forms<br>**3.2 Design using K-map**<br>• Half and Full Adder,<br>• Half and Full Subtractor | **10** | **16** |

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| | **3.3 Code Converter using K-map**<br>• Gray to Binary,<br>• Binary to Gray Code (upto 4bit) | | |
| | **3.4 IC 7447 as BCD to 7 segment decoder – driver** | | |
| | **3.5 IC 7483 as Adder & Subtractor, 1 digit BCD adder.** | | |
| | **3.6 ALU (Truth table & Block Diagram)**<br>• IC 74181<br>• IC 74381. | | |
| | **3.7 Applications and realization**<br>• Necessity of combinational circuit.<br>• Multiplexers( MUX ): study of IC 74151 ,MUX tree<br>• Demultiplexers ( DEMUX): study of IC 74155 ,Demultiplexer tree, Demultiplexer as decoder<br>• Encoder: Priority Encoder 8:3, Decimal to BCD Encoder<br>• Tristate logic, Unidirectional & bidirectional buffer ICs: IC 74244 and IC 74245 | | |
| **4.** | **Sequential Logic Circuits** | | |
| | **4.1 Sequential circuits:**<br>• Comparison between Combinational & Sequential circuits,<br>• One bit memory cell - RS latch – using NAND & NOR.<br>• Edge and level trigger<br>• Flip Flops - S R Flip flop, Clocked SR flip flop with preset and clear,<br>• Drawbacks of SR Flip flop<br>• Clocked JK Flip flop with preset & clear, Race around condition in JK flip-flop, Master slave JK flip flop.<br>• D and T type flip flop.<br>• Excitation table of flip flops. | **10** | **16** |
| | **4.2 Study of Counters :**<br>• Counter: Modulus of counter, their types as Asynchronous and Synchronous counter.<br>• Asynchronous counter: ( Ripple counter , 4 bit up/down Counter<br>• Synchronous counter: Excitation table of flip flops, implementation of 3bit synchronous counter, its truth table and waveforms.<br>• Block schematic and waveform , IC 7490 as MOD-N Counter | | |

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| | **4.3 Shift Register:**<br>• Logic diagram , Truth Table and waveforms of :<br>4-bit Shift registers (SISO,SIPO, PISO,PIPO)<br>• 4 Bit Universal Shift registers.<br>Applications of Shift Register (Logic Diagram with waveforms ) of: Ring counter, Twisted ring counter | | |
| **5.** | **Analog to Digital and Digital to Analog converter** | | |
| | **5.1 Necessity of Code** | **08** | **14** |
| | **5.2 Digital to Analog converter**<br>• Types of DAC along with Mathematical derivation: Weighted resistor method and R-2R Method<br>• Comparison of types of DAC | | |
| | **5.3 Analog to Digital converter** (Block diagram & working )<br>• Single slope ADC<br>• Dual slope ADC<br>• SAR ADC | | |
| | **5.4 Use of IC 0800, 0809 in practical applications** | | |
| **6.** | **Memories** | | |
| | **6.1 Principle of operation and classification of memory.**<br>• Organization of memories<br>• RAM (Static, Dynamic), Volatile and Non-Volatile<br>• ROM (PROM, EPROM, EEPROM)<br>• Flash memory.<br>• Comparison between EPROM and Flash | **06** | **08** |
| | **6.2 Study of memory ICs :**<br>• Identification of IC number and their function of following ICs: IC 7481& IC 6116. | | |
| | **TOTAL** | **48** | **80** |

**List of Practical/Experiments/Assignments:**

| Sr. No. | Name of Experiment/Assignment |
|---|---|
| 1. | To check different IC's using IC tester. |
| 2. | Verify Truth table of basic logic gates ,universal gate. |
| 3. | Verify NAND and NOR gate as universal logic gate. |
| 4. | Verify De Morgan's Theorem |
| 5. | Realize half Adder & Full Adder |
| 6. | Realize Half Subtractor & Full subtractor |
| 7. | Verify the operation of Multiplexer IC 74151 and Demultiplexer IC 74155. |
| 8. | Verify truth table of Encoder & Decoder |
| 9. | Realize and verify RS flip flop using NAND gate and verify master slave JK Flip-Flop |
| 10. | Implement 4 bit ripple counter/Decade counter. |
| 11. | Verify the operational features of ADC – IC 0809/IC 0808 and DAC 0800 |
| 12. | Implement 3 bit R-2R D/A converter |
| 13. | To study ALU IC 74181 |
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**Instructional Strategy:**

| Sr. No. | Topic | Instructional Strategy |
|---|---|---|
| 1. | Number System | Classroom Teaching |
| 2. | Digital Logic Families | Classroom Teaching & Laboratory work |
| 3. | Combinational Logic Circuits | Classroom Teaching & Laboratory work |
| 4. | Sequential Logic Circuit | Classroom Teaching & Laboratory work |
| 5. | Analog to Digital and Digital to Analog converter | Classroom Teaching & Laboratory work |
| 6. | Memories | Classroom Teaching ,Projector & PPTs |

**Text Books:**

| Sr. No | Author | Title | Publication |
|---|---|---|---|
| 1. | Malvino Leach | Principles of Digital Electronics | Mcgraw Hill |
| 2. | R.P.Jain | Digital Electronics | Tata Mcgraw Hill |
| 3. | Anand Kumar | Fundamental of Digital Electronics | PHI |

**Reference Books:**

| Sr. No | Author | Title | Publication |
|---|---|---|---|
| 1. | Anil K. Maini | Digital Electronics, Principles and Integrated Circuits | Wiely India Edition |
| 2. | Mathur | Introduction to microprocessor | Tata Mcgraw Hill |

**Learning Resources :**
Reference Books, Manuals and journals of devices, Components brochures

**Specification Table:**

| Sr. No. | Topic | Cognitive Levels | | | Total |
|---|---|---|---|---|---|
| | | Knowledge | Comprehension | Application | |
| 1. | Number System | 4 | 8 | 2 | 14 |
| 2. | Logic families and gates | 2 | 4 | 6 | 12 |
| 3. | Combinational Logic Circuits | 4 | 8 | 4 | 16 |
| 4. | Sequential Logic Circuit | 4 | 8 | 4 | 16 |
| 5. | Analog to Digital and Digital to Analog converter | 2 | 8 | 4 | 14 |
| 6. | Memories | 4 | 4 | -- | 08 |
| **Total** | | **20** | **40** | **20** | **80** |

**Prepared By:**

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|---|---|---|
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| Lect. In E &TC | Member Secretary, PBOS | Chairman, PBOS |