

EC : ELECTRONICS AND COMMUNICATIONS
IN : INSTRUMENTATION ENGINEERING

Module 3 : Digital Circuits

INDEX

| Sr. No. | Contents | Topics | Pg. No. |
|-------------------------------|----------------------------|---|---------|
| 1. Boolean Algebra | | | |
| | Notes | Introduction | 1 |
| | | Number System | 1 |
| | | Binary Number System | 2 |
| | | Binary Arithmetic | 6 |
| | | Octal Number System (BASE 8) | 9 |
| | | Hexadecimal Number System (BASE 16) | 11 |
| | | Codes | 13 |
| | | Logic Gates | 17 |
| | | Boolean Algebra | 22 |
| | | Standard Representation of Logic Functions | 27 |
| | | Circuit Minimization | 29 |
| | | Karnaugh Map (K-MAP) | 30 |
| | | Don't-Care Input Combinations | 38 |
| | LMR (Last Minute Revision) | 39 | |
| Assignment-1 | Questions | 42 | |
| Test Paper-1 | Questions | 45 | |
| 2. Digital IC Families | | | |
| | Notes | Introduction | 47 |
| | | Characteristics of Digital Families | 48 |
| | | Resistor – Transistor Logic (RTL) | 49 |
| | | Direct Coupled Transistor Logic (DCTL) | 52 |
| | | Integrated – Injection Logic (I ² L) | 52 |
| | | Diode Transistor Logic (DTL) | 53 |
| | | Transistor – Transistor Logic (TTL) | 54 |
| | | Emitter Coupled Logic (ECL) | 59 |
| | | Unipolar Logic Families | 60 |
| | | Interfacing Between Logic Families | 64 |
| | | Open Collector Gates and Wire ANDing | 70 |

| Sr. No. | Contents | Topics | Pg. No. |
|--|--------------|--|---------|
| | | Tri-State TTL Device | 71 |
| | | Tri-State Buffer | 73 |
| | | Current Parameter for TRI – State Buffer | 74 |
| | | LMR (Last Minute Revision) | 74 |
| | Assignment–2 | Questions | 76 |
| | Test Paper–2 | Questions | 80 |
| 3. Combinational Logic Circuits, MUX and Decoders | | | |
| | Notes | Introduction | 83 |
| | | Implementing Combinational Logic | 83 |
| | | Code Converters | 85 |
| | | Multiplexer | 90 |
| | | Demultiplexer/Decoders | 95 |
| | | Special Decoders | 100 |
| | | Encoders | 100 |
| | | Functions of Combinational Logic | 103 |
| | | Comparators | 109 |
| | | LMR (Last Minute Revision) | 112 |
| | Assignment–3 | Questions | 114 |
| | Test Paper–3 | Questions | 118 |
| 4. Sequential Logic Circuits | | | |
| | Notes | Introduction | 122 |
| | | Classification of Sequential Circuits | 122 |
| | | Flip Flops | 123 |
| | | S–R Flip-Flop | 123 |
| | | J–K Flip-Flop | 126 |
| | | Master – Slave J–K Flip-Flop | 127 |
| | | D–Flip-Flop | 128 |
| | | T–Flip-Flop | 129 |
| | | Excitation Table of Flip Flop | 130 |
| | | Conversion From One Type of Flip – Flop to Another | 131 |
| | | Important Parameters of Flip Flop | 132 |
| | | Applications of Flip–Flop | 132 |
| | | Clocked Sequential Circuit Analysis | 142 |
| | | LMR (Last Minute Revision) | 145 |
| | Assignment–4 | Questions | 146 |
| | Test Paper–4 | Questions | 150 |

| Sr. No. | Contents | Topics | Pg. No. |
|--|--------------------------------|--|---------|
| 5. A/D Converters, D/A Converters and Semiconductors Memories | | | |
| | Notes | Introduction | 153 |
| | | Digital to Analog Converters | 153 |
| | | Types of Commonly Used D/A Converters | 153 |
| | | Performance Characteristics for D/A Converter | 156 |
| | | Analog-to-Digital Converters (A/D) | 158 |
| | | Flash A/D Converter | 159 |
| | | Successive Approximation A/D Converter | 160 |
| | | Counter Type A/D Converter | 161 |
| | | Dual-Slope A/D Converter | 162 |
| | | A/D Converter Using Voltage-Frequency Conversion | 164 |
| | | Summary of A/D Converter Types | 166 |
| | | Semiconductor Memories | 167 |
| | | Memory Organization and Operation | 167 |
| | | Expanding Memory Size | 170 |
| | | Memory Classification | 173 |
| | | Random Access Memories (RAM) | 174 |
| | | Read Only Memories (ROM) | 177 |
| | | PAL – Programmable Array Logic | 178 |
| | PLA – Programmable Logic Array | 178 | |
| | LMR (Last Minute Revision) | 179 | |
| | Assignment–5 | Questions | 180 |
| Test Paper–5 | Questions | 182 | |
| 6. Microprocessor (IC 8085) | | | |
| | Notes | Introduction | 185 |
| | | 8085 Microprocessor | 186 |
| | | The 8085 Microprocessor Architecture: Functional Block Diagram | 190 |
| | | Memory and I/O Interfacing | 197 |
| | | The 8085 Interrupt | 202 |
| | | Addressing Modes of 8085 | 204 |
| | | Instruction Set of 8085 and Programming | 206 |
| | | Interfacing Input/Output Devices | 221 |
| | | Direct Memory Access (DMA) | 225 |
| | | Microcontrolars (* Only For IN) | 226 |
| | | LMR (Last Minute Revision) | 228 |

| Sr. No. | Contents | Topics | Pg. No. |
|--------------------------|--------------------------|---------------|----------------|
| | Assignment – 6 | Questions | 230 |
| | Test Paper – 6 | Questions | 233 |
| | Practice Problems | Questions | 236 |
| SOLUTIONS | | | |
| Assignment | Answer Key | | 253 |
| | Model Solutions | | 255 |
| Test Paper | Answer Key | | 272 |
| | Model Solutions | | 274 |
| Practice Problems | Answer Key | | 289 |
| | Model Solutions | | 291 |
