Course Code	Course Name	Credits
MTC304	**Basic Electronics and Digital Circuit Design**	**03**

Prerequisite: FEC105 Basic Electrical Engineering, FEC102 Engineering Physics-I, FEC202 Engineering Physics-II

Objectives

1. To understand working and performance of electronic devices
2. To understand applications of electronic devices.
3. To teach fundamental principles of digital circuit design.
4. To impart the testing knowledge of digital circuits.

Outcomes: Learner will be able to…

1. Illustrate working of Transistors & its applications.
2. Describe several JFET applications including switch & amplifiers.
3. Describe the number system and operations of logical gates
4. Design combinational digital logic circuits
5. Design Sequential digital logic circuits
6. Describe the testing technologies in digital electronics.

Module	Detailed Contents	Hrs.
01	**BJT:** 1.1 **BJT** operation, BJT Voltages and Currents, BJT amplification, Common Base, Common Emitter and Common Collector Characteristics. 1.2 **Transistor Biasing**: Need of biasing, Voltage divider biasing, Base biasing, 1.3 **Applications**: BJT as a switch, BJT as amplifier	**6**
02	2.1 **Junction Field Effect Transistor JFET: C**onstruction, pinch off voltage, transfer characteristic, trans-conductance. Application: JFET as switch, JFET as amplifier 2.2 **Metal-Oxide Effect Transistor (MOSFET): Working** of MOSFET, Application: MOSFET as switch	**5**
03	**Fundamentals of Digital Design** **3.1 Number System -** Review of Number System, Binary Code, Binary Coded Decimal, Hexadecimal Code, Gray Code and their conversions, 3.2 **Logic Gates**: Basic gates, Universal gates, Sum of products and products of sum, minimization with Karnaugh Map (upto four variables) and realization. 3.3 **Combinational Circuits using basic gates as well as MSI devices**: Half adder, Full adder, Half Subtractor, Full Subtractor, multiplexer, demultiplexer, decoder, Comparator (Multiplexer and demultiplexer gate level upto 4:1).	**10**
04	**Elements of Sequential Logic Design** : 4.1 **Sequential Logic**: Latches and Flip-Flops, Conversion of flip flops (timing considerations and metastability are not expected) 4.2 **Counters**: Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters, Ring Counters, Shift registers, Universal Shift Register.	**8**
05	**Sequential Logic Design:** 5.1 Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques and state assignment, Clocked synchronous state machine design. (Complex word problems like traffic light controller etc. are not expected)	**7**

	5.2 MSI counters (7490, 74163, 74169) and applications	
06	**Testability:** Fault Models, Stuck at faults, ATPG, Design for Testability, Boundary Scan Logic, JTAG and Built in self test.	**3**
Self-study Topic	**VHDL**: Data types, Structural Modeling using VHDL, attributes, data flow, behavioral, VHDL implementation of basic combinational and sequential Circuits.	**--**

Assessment:

Internal Assessment for 20 marks: Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

End Semester Theory Examination:

1. Question paper will comprise of total 06 questions, each carrying 20marks.
2. Total 04 questions need to be solved.
3. Question No: 01 will be compulsory and based on entire syllabus wherein sub- questions of 2 to 5 marks will be asked.
4. Remaining questions will be mixed in nature.(e.g. Suppose Q.2 has part (a) from module3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hrs as mentioned in the syllabus.

Text Books:

1. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill Education, Third Edition 2003
2. Applied Electronics by R. S. Sedha, S. Chand Limited, 2008
3. Prin. Of Electronic Devices & Circuit by B.L. Theraja and R. S. Sedha

References:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, TATA McGraw Hill, 2nd Edition, New Delhi
2. William I. Fletcher, 'An Engineering Approach to Digital Design', PHI.
3. B. Holdsworth and R. C. Woods, 'Digital Logic Design', Newnes, 4 th Edition
4. Morris Mano, Digital Design, Pearson Education, Asia 2002.
5. John F. Wakerley, Digital Design Principles And Practices, third Edition Updated, Pearson Education, Singapore, 2002
6. Anil K. Maini, Digital Electronics, Principles, Devices and Applications, Wiley
7. Stephen Brown and ZvonkoVranesic, Fundamentals of digital logic design with VHDL, McGraw Hill, 2nd Edition
8. Electronic Principles 8th Edition By Albert Malvino and David Bates