SCHEME OF EXAMINATION

FOR

MASTER OF TECHNOLOGY

[INFORMATION AND COMMUNICATION TECHNOLOGY]

WITH

SPECIALIZATION IN CYBER SECURITY/ MOBILE & PERVASIVE COMPUTING/ EMBEDDED SYSTEMS

PART-TIME PROGRAMME

Offered by

(www.igdtuw.ac.in)

Indira Gandhi Delhi Technical University for Women

(Established by Govt. of Delhi vide Act 09 of 2012)

Kashmere Gate, Delhi-110006

PROGRAMME ESSENTIALS

Maximum Intake to the M.Tech (ICT) Programme will be: 60

Eligibility Criteria:

BE/B.Tech (CS/IT/ECE/EEE/Instrumentation or equivalent) with 60%

or

MSc (CSE/IT/Electronics) with 60%

or

MCA/ DOEACC-B level with 60%

Preference will be given to the candidates having professional/working experience.

Curriculum Requirements:

(i) The Programme offers the following three specializations from semester IV onwards:
- Cyber Security
- Mobile and Pervasive Computing
- Embedded Systems

(ii) Student may choose any one of the specialization in Semester IV onwards. Minimum 15 students must opt a specialization to be offered during the Programme.

(iii) Specialization once opted cannot be changed in the subsequent semesters.

(iv) The total number of credits of the Programme M. Tech (ICT) = 104.

(v) Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits.

MASTER OF TECHNOLOGY (ICT)-PART TIME
(Teaching and Examination Scheme)

FIRST SEMESTER

Paper Code	Paper Title	L	P	Credit
THEORY				
MCW-501	Data Structure and Algorithms	4	-	4
MEW-503	Digital and Data Communication	4	-	4
MIW-505	Computer Graphics and Multimedia	4	-	4
PRACTICALS				
MCW -551	Data Structure and Algorithms Lab	-	2	1
MEW -553	Digital and Data Communication Lab	-	2	1
MIW -555	Computer Graphics and Multimedia Lab	-	2	1
ICT-557	Technical Report Writing	-	2	1
	TOTAL	**12**	**8**	**16**

SECOND SEMESTER

Code	Course Title	L	P	Credit
THEORY				
MIW-502	Discrete Structure	4	-	4
MCW-504	Advanced Computer Networks	4	-	4
MEW -506	Digital System Design	4	-	4
PRACTICALS				
MIW -552	Discrete Structure Lab	-	2	1
MCW -554	Advanced Computer Networks Lab	-	2	1
MEW -556	Digital System Design Lab	-	2	1
ICT -558	Term Paper-I	-	2	1
	TOTAL	**12**	**8**	**16**

THIRD SEMESTER

Code	Course Title	L	P	Credit
THEORY				
MIW-601	Applied Cryptography	4	-	4
MCW -603	Wireless Networks	4	-	4
MEW -605	Microcontrollers and Applications	4	-	4
PRACTICALS				
MIW -651	Applied Cryptography Lab	-	2	1
MCW -653	Wireless Network Lab	-	2	1
MEW -655	Microcontrollers and Applications Lab	-	2	1
ICT-657	Term Paper-II	-	2	1
	TOTAL	**12**	**8**	**16**

SPECIALIZATION IN CYBER SECURITY

FOURTH SEMESTER

Code	Course Title	L	P	Credit
THEORY ELECTIVES (Choose any THREE)				
MIW-602	Information Security Audit	4	-	4
MIW-604	Cyber Forensics	4	-	4
MIW-606	Advanced Database Management Systems	4	-	4
MIW-608	Ethical Hacking and Threat Management	4	-	4
MIW-610	Soft Computing	4	-	4
PRACTICALS (Lab based on Electives)				
MIW-652	Information Security Audit Lab	-	2	1
MIW-654	Cyber Forensic Lab	-	2	1
MIW-656	Advanced Database Management Systems Lab	-	2	1
MIW-658	Ethical Hacking and Threat Management Lab	-	2	1
MIW-660	Soft Computing Lab	-	2	1
MIW-662	Term Paper-III	-	-	1
	TOTAL	**12**	**6**	**16**

FIFTH SEMESTER

Code	Course Title	L	P	Credit
THEORY ELECTIVES (Choose any THREE)				
MIW-701	Operating System Security	4	-	4
MIW-703	Cloud Computing Architecture	4	-	4
MIW-705	Vulnerability Assessment and Penetration Testing	4	-	4
MIW -707	Cyber Laws and IPR	4	-	4
MIW-709	Special Topics on Cyber Security	4	-	4
PRACTICALS (Lab based on Electives)				
MIW-751	Operating System Security Lab	-	2	1
MIW-753	Cloud Computing Architecture Lab	-	2	1
MIW-755	Vulnerability Assessment and Penetration Testing Lab	-	2	1
MIW-757	Case Study based on Cyber Laws and IPR	-	2	1
MIW-759	Special Topics on Cyber Security Lab	-	2	1
MIW-761	Minor Project	-	-	5
	TOTAL	**12**	**6**	**20**

SIXTH SEMESTER

Code	Course Title	L	P	Credit
THEORY				
MIW-702	Dissertation	-	20	20
TOTAL			**20**	**20**

SPECIALIZATION IN MOBILE AND PERVASIVE COMPUTING

FOURTH SEMESTER

Code	Course Title	L	P	Credit
THEORY ELECTIVES (Choose any THREE)				
MEW -602	Mobile Computing	4	-	4
MCW -604	Mobile Cloud Computing	4	-	4
MCW -606	Mobile Database Management Systems	4	-	4
MCW -608	Internet of Things	4	-	4
MIW-610	Soft Computing	4	-	4
PRACTICALS (Lab based on Electives)				
MCW-652	Mobile Computing Lab	-	2	1
MCW-654	Mobile Cloud Computing Lab	-	2	1
MCW-656	Mobile Database Management Systems Lab	-	2	1
MCW-658	Internet of Things Lab	-	2	1
MIW-660	Soft Computing Lab	-	2	1
MCW-662	Term Paper-III	-	-	1
	TOTAL	**12**	**6**	**16**

FIFTH SEMESTER

Code	Course Title	L	P	Credit
THEORY ELECTIVES (Choose any THREE)				
MCW -701	Pervasive Computing	4	-	4
MCW -703	Design and Development of Mobile and Handheld Devices	4	-	4
MCW -705	Mobile Programming and App Development	4	-	4
MCW -707	Data Mining and Big Data Analytics	4	-	4
MCW-709	Special Topics in Mobile and Pervasive Computing	4	-	4
PRACTICALS (Lab based on Electives)				
MCW-751	Pervasive Computing Lab	-	2	1
MCW-753	Design and Development of Mobile and Handheld Devices Lab	-	2	1
MCW-755	Mobile Programming and App Development Lab	-	2	1
MCW-757	Data Mining and Big Data Analytics Lab	-	2	1
MCW-759	Special Topics in Mobile and Pervasive Computing Lab	-	2	1
MCW-761	Minor Project	-	-	5
	TOTAL	**12**	**6**	**20**

SIXTH SEMESTER

Code	Course Title	L	P	Credit
THEORY				
MCW-702	Dissertation	-	20	20
TOTAL			**20**	**20**

SPECIALIZATION IN EMBEDDED SYSTEMS

FOURTH SEMESTER

Code	Course Title	L	P	Credit
THEORY ELECTIVES (Choose any THREE)				
MEW-602	Mobile Computing	4	-	4
MEW-604	Digital Signal Processors and Architectures	4	-	4
MEW-606	Embedded Systems Design	4	-	4
MCW-608	Internet of Things	4	-	4
MIW-610	Soft Computing	4	-	4
PRACTICALS (Lab based on Electives)				
MEW-652	Mobile Computing Lab	-	2	1
MEW-654	Digital Signal Processors and Architectures Lab	-	2	1
MEW-656	Embedded Systems Design Lab	-	2	1
MEW-658	Internet of Things Lab	-	2	1
MIW-660	Soft Computing Lab	-	2	1
MEW-662	Term Paper-III	-	-	1
	TOTAL	**12**	**6**	**16**

FIFTH SEMESTER

Code	Course Title	L	P	Credit
THEORY ELECTIVES (Choose any THREE)				
MEW-701	Wireless Technology for Embedded System	4	-	4
MCW -703	Design and Development of Mobile and Handheld Devices	4	-	4
MEW-705	Machine to Machine Communication	4	-	4
MEW -707	Real Time Systems	4	-	4
MEW-709	Special Topics in Embedded Systems	4	-	4
PRACTICALS (Lab based on Electives)				
MEW-751	Wireless Technology for Embedded System Lab	-	2	1
MCW-753	Design and Development of Mobile and Handheld Devices Lab	-	2	1
MEW-755	Machine to Machine Communication Lab	-	2	1
MEW-757	Real Time Systems Lab	-	2	1
MEW-759	Special Topics in Embedded Systems Lab	-	2	1
MEW-761	Minor Project	-		5
	TOTAL	**12**	**6**	**20**

SIXTH SEMESTER

Code	Course Title	L	P	Credit
THEORY				
MEW-702	Dissertation	-	20	20
TOTAL			**20**	**20**

Paper Code: MCW-501 **L P C**
Paper Title: Data Structure and Algorithms **4 0 4**

INSTRUCTIONS TO PAPER SETTERS: MAXIMUM MARKS: 60

1. **Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.**
2. **Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.**

Unit-I

Algorithms performance analysis: Time and space complexity, Asymptotic Notations, Complexity Analysis Examples.
Linear Data Structures: Arrays, Stacks, Queues, Linear linked lists, circularly linked lists and doubly linked lists.
Recursion: Design of recursive algorithms, solving recurrences. **[10 Hrs]**

Unit-II

Non-linear Data Structure: Trees, Traversals, Threaded Tree, Binary Search Trees, AVL tree, B-trees, Graphs.
Graph Algorithms: DFS, BFS, Kruskal's and Prim's algorithm for Minimum Spanning Tree, Shortest path Algorithms. **[10 Hrs]**

Unit-III

Sorting and Searching Algorithms: Quick Sort, Merge Sort, Heap sort and other sorting; Linear Search and Binary Search.
Hashing: Hashing Functions, collision Resolution Techniques. **[10 Hrs]**

Unit-IV

Algorithm Strategies: Greedy paradigm, Divide and conquer paradigm and, Dynamic-programming paradigm, Case studies on algorithm strategies.
NP Completeness: P, NP, NP-complete, NP-Hard categories of problems, Cook's theorem, approximation algorithms. **[10 Hrs]**

Text books:

1. Y. Langsam et. al., "Data Structures using C and C++", PHI, 2nd edition, 2009.
2. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Booksource Pvt. Ltd, 1999.
3. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Ed., PHI, 2011.

Reference books:

1. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI, 2000.
2. Ellis Horowitz and Sartaz Sahani, "Fundamental of Computer Algorithms", Galgotia Publications, 1999.
3. A. V. Aho, J. E. Hopcroft, J. D. Ullman, "The Design and Analysis of Computer Algorithms", Addition Wesley, 1998.
4. D. E. Knuth, "The Art of Computer Programming", 2nd Ed., Addison Wesley, 1998.

Paper Code: MEW-503 **L P C**
Paper: Digital and Data Communications **4 0 4**

INSTRUCTIONS TO PAPER SETTERS **MAXIMUM MARKS: 60**

1. **Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.**
2. **Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.**

Unit-I

Introduction to digital communication: Signal space representation, Digital communication system (description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt orthogonalization procedure. M-ary orthogonal signals, bi-orthogonal signals, simplex signal waveforms.

Modulation Techniques: Pulse amplitude modulation (binary and M-ary, QAM), Pulse position modulation (binary and M-ary), Carrier modulation (M-ary ASK, PSK, FSK, DPSK), Continuous phase modulation (QPSK and variants, MSK, GMSK). Power spectrum of digitally modulated signals. **[10 hrs]**

Unit-II

Receivers for AWGN channel: Optimum Receivers for AWGN Channels, Channel models; optimal detection and error probability for band limited channels; Coherent and Non coherent detection. Detector: Optimum rule for ML and MAP detection Performance: Bit-error-rate, symbol error rate for coherent and non-coherent schemes. Carrier and Symbol Synchronization: Signal parameter estimation, Carrier phase estimation, symbol timing estimation.

Communication over fading channels: Characteristics of fading channels, Rayleigh and Rician channels, receiver performance-average SNR, outage probability, amount of fading and average bit/symbol error rate. Capacity and coding in fading channels. **[10 hrs]**

Unit-III

Introduction to Data Communications: Goals and applications of Networks, Layering Concept, OSI Reference Model vs TCP/IP Protocol Suite, Networks Topology. Physical Layer: Signals, Digital Transmission, Analog to Digital & Digital to Digital conversion, Analog Transmission, Digital to Analog Conversion, Multiplexing (FDM & TDM), Media (Guided and Unguided), Switching (Packet based & Circuit based), Hub & Repeater, Sampling theorem (Nyquist-Shannon Theorem). **[10 hrs]**

Unit-IV

Data Link Layer: Addressing, Error Detection & Correction, General concepts, Checksum & CRC, Medium Access (Aloha, CSMA, CSMA/CD & CA), Protocols (Ethernet, ARP & RARP). **Network Layer:** IP Addressing & Subnets, basic Routing (or Forwarding) Mechanism, IPv4 frame format and functions. **Transport Layer:** Port. Addresses, Protocols (Simplex, Stop n Wait, Go Back N & Selective Repeat), ARQ. UDP services & applications, TCP header format, connection setup & termination, state transition diagram, now control, error control, congestion control & timers. **Application Layer:** Web & HTTP, FTP, Email, Telnet, SSH, DNS.

[10 hrs]

Text Books

1. J. G. Proakis and M. Salehi, Fundamentals of Communication Systems, Pearson Education, 2005.
2. S. Haykins, Communication Systems, 5th ed., John wiley, 2008.
3. A. S. Tanenbaum, "Computer Networks," PHI, 4th Edition, 2002.
4. Forouzan, "Data Communication and Networking," TMH, 5th Edition, 2013.

References Books

1. M. K. Simon, S. M. Hinedi and W. C. Lindsey, Digital Communication Techniques: Signaling and Detection, Prentice Hall India, N. Delhi, 1995.
2. W. Tomasi, Advanced Electronic Communication Systems, 4th Ed., Pearson Education, 1998.
3. M. K. Simon and M. S. Alouini, Digital Communication over Fading Channels, John Wiley Publishers 2005.
4. Wayne Tomasi, "Introduction to Data Communications and Networking," Pearson Education.
5. Fred Halsll, Lingana Gouda Kulkarni, "Computer Networking and Internet,"5th Edition, Pearson Education.

Paper Code: MIW-505	**L**	**T**	**P**
Paper Title: Computer Graphics and Multimedia	**4**	**0**	**4**

INSTRUCTIONS TO PAPER SETTERS **MAXIMUM MARKS: 60**

1. **Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.**
2. **Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.**

UNIT I

Introduction: Basic raster graphics algorithms for drawing 2 D Primitives line, circles, ellipses. Anti-aliasing techniques. **Clipping:** Clipping points, Cohen Sutherland line clipping, Sutherland Hodgeman polygon clipping. **Geometric Transformation**: 2D transformations like translation, rotation, scaling, reflection and shearing, composite transformation and homogeneous coordinate system in transformation, 3D transformations, window to viewport transformations. **[10 Hrs]**

UNIT II

Projection: Types of projection methods, perspective projection, parallel projection, vanishing points. **Curves and Surfaces:** parametric and non parametric, Hermite, Bezier, B-Spline, Surfaces, **Solid Modeling and Procedural modeling:** Sweep Representation, Boundary Representation, Octrees, CSG, fractals and its generation techniques, grammar-based models, multi-particle system. **[10 Hrs]**

UNIT III

Illumination and Shading models: Global and local illumination model, Lambert, gouraud and phong methods, Color Models, Transparency, Shadows, **Visible surface determination:** Z-buffer algorithm, A buffer algorithm, scan line algorithm, area subdivision algorithm. **Animation:** Introduction to 2D and 3D animation. Dynamics and role of dynamics in animation. **[10 Hrs]**

Unit IV

Introduction to Multimedia: Multimedia, Multimedia Terms, Multimedia Authoring Tools. **Multimedia information representation** – Digitization principle**,** Text, Images, Audio and Video. **Compression Techniques:** Principles, Lossless and Lossy compression, Static Huffman technique, Dynamic Huffman Technique, Arithmetic Coding, Lempel-Ziv-Welsh Coding, GIF, TIFF, JPEG, MPEG. **[10 Hrs]**

Text Books:

1. Foley, van Dam, Feiner and Hughes, "Computer Graphics: Principles & Practice in C", 2/e, Pearson Education, 2002.
2. Fred Halsall, "Multimedia Communication: Applications, Networks, Protocols and Standards", 1/e, Pearson Education, 2001

Reference Books:

1. Hearn and Baker, "Computer Graphics", 2/e, Pearson Education, 1997.
2. R. Plastock and G. Kalley, "Computer Graphics", 2nd Edition, McGraw-Hill, 2006.
3. D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, McGraw-Hill, 2002.
4. Tay Vaughan, Multimedia: Making It Work", 9th edition, Mc-Graw-Hill, 2014.

Paper Code: MIW-502 | **L** | **P** | **C**
Paper Title: Discrete Structures | **4** | **0** | **4**

INSTRUCTIONS TO PAPER SETTERS **MAXIMUM MARKS: 60**

1. **Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.**
2. **Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.**

Unit I

Introduction: Set Theory, Counting Principles, Cayley's Theorem, Relations, Properties of relations, Equivalence class, partitions, Closures, Functions, one-to-one, onto, inverse, composition**.**

Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram. **Lattices:** Definition, Properties of lattices – Bounded, Complemented, Boolean lattice, Boolean Algebra. **[10 hrs]**

Unit II

Binary Logic: Proposition, Tautology, Satisfiability, Contradiction, Proof methods, Rules of Inference. Predicate Calculus: Quantifiers, Inference theory of predicate logic.

Number Theory: Divisibility and division, Greatest Common Divisors, the Euclidean algorithm for computing gcd (m, n), The extended Euclidean algorithm, The Fundamental Theorem of Arithmetic Modular arithmetic and residue classes, Arithmetic on residue classes. **[10 hrs]**

Unit III

Combinatorics and Probability: Fundamental Counting Principles, Random experiments, trial, sample space, events, Theorems on probabilities of events, Addition rules of probability, Conditional probability, Independence of events, Multiplication rule of probability, Bayes theorem and its applications, Complexity, Bernoulli's Theorem, Introduction to Information Theory, Applications of probability in Information Theory and Security. **[10 hrs]**

Unit IV

Formal Languages and Finite-State Machines: Formal Languages, Grammars, Finite-state machines and their transition table diagrams, Finite-state Automata, Deterministic Finite-State Automata and Regular Languages, Non-deterministic finite-State Automata.

Random Number Generation: Properties of random numbers, Techniques for generating random numbers, Tests for random numbers: Diehard tests, NIST Test. **[10 hrs]**

Text books:

1. Thomas Koshy, "Discrete Mathematics with Applications", 1st Edition, Elsevier, 2006.
2. Kolman, R.C. Busby, and S.C. Ross, Discrete Mathematical Structures, 6/e, Pearson Education, 2008.

Reference books:

1. C.L. Liu, "Elements of Discrete Mathematics", 4e, TMH, 2012.
2. Sheldon Ross, "A First Course in Probability", 9/e, Pearson Education, 2012.
3. Sheldon Ross, "Simulation", 5th edition, Elsevier, 2012.

Paper Code: MCW-504 **L P C**
Paper Title: Advanced Computer Networks **4 0 4**

INSTRUCTIONS TO PAPER SETTERS **MAXIMUM MARKS: 60**

1. **Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.**
2. **Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.**

Unit-I

Protocol and Network Fundamentals: Internet Evolution, Packet Switched Networks, TCP/IP Protocol Architecture, OSI Model, Internetworking, Overview of User Datagram Protocol and Internet Protocol.

Multi-access Communication: Aloha Modelling, Carrier Sensing: CSMA/CA/CD, MACA, MACAW, 802.11 MAC Protocol. **[10 Hrs]**

Unit-II

Delay Models In Data Networks: Characteristics of Queuing System, Little's Theorem, Queuing Models, Single Server Queues, Multi Server Queues, Priority Queuing, and Networks of Queues. **[10 Hrs]**

Unit-III

Congestion Control and Traffic Management: Congestion Control in Data Network and Internet, Link level flow control, Link level error control, TCP traffic control. **[10 Hrs]**

Unit-IV

Internet Routing: Shortest Path Length Determination, Interior Routing Protocols and Exterior Routing Protocol; Multicasting.

Multimedia Networking: Multimedia Networking Applications, Audio and Video Streaming, Real Time Streaming Protocol (RTSP), RTP, Overview of QoS, Integrated Services, Differentiated

Services, Random Early Detection (RED), Resource Reservation Protocol (RSVP). **[10 Hrs]**

Text books:

1. Dimitri Bersekas, Robert Gallager, "Data Networks", Second Edition, Pearson Education, 2006.
2. William Stallings, "High Speed Networks and Internets", Second Edition, Pearson Education, 2010.

Reference books:

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Third Edition, Pearson Education, 2007.
2. Nader F. Mir, "Computer and Communication Networks", Pearson Education, 2007.
3. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata McGraw Hill, 2007.
4. S.Keshav, "An Engineering Approach to Computer Networking", Pearson Education, 1997.
5. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, Prentice Hall, 2011.

Paper Code: MEW-506 **L P C**
Paper: Digital System Design **4 0 4**

INSTRUCTIONS TO PAPER SETTERS **MAXIMUM MARKS: 60**

1. **Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.**
2. **Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 10 marks.**

UNIT I

Introduction to VHDL: Behavioural Modeling, Transport vs Inertial Delay, Simulation Deltas, Sequential Processing, Process Statement, Signal Assignment vs Variable Assignment, Sequential Statements, Data Types, Subprograms and Packages, Predefined Attributes, Configurations, Subprogram Overloading, VHDL synthesis, Design Examples. **[10 hrs]**

UNIT II

Analysis of Clocked sequential Networks: Sequential parity checker, State tables and graphs, General models for sequential networks, Derivations of State Graphs and Tables, Sequence detector, Reduction of state Tables State Assignment, Sequential Network Design. **[10 hrs]**

UNIT III

Programmable LSI Techniques, Programmable Logic Arrays, Programmable Array Logic, Sequential PLDs, Sequential Circuit Design using PLDs, Complex Programmable Logic Devices and Field Programmable Gate Arrays, Altera Series FPGAs and Xilinx Series FPGAs. **[10 hrs]**

UNIT IV

Introduction to Testing and Diagnosis, Fault modelling, Logical fault models, Fault Detection and Redundancy, Fault Equivalence and Fault Location, Fault Dominance, Single stuck model, Multiple stuck model, Bridging faults. **Design for Testability:** Testability, Ad hoc Design, Scan Registers and scan techniques, Boundary scan standards, Built in Self Test: Introduction, Test Pattern generation, Generic Off line BIST Architectures, Compression Techniques- General aspects, Signature Analysis. **[10 hrs]**

Text Books:

1. Jan M.Rabaey, Anantha Chandrakasan and Borivoje Nikolic , "Digital integrated circuits- A design perspective" , Pearson Education Taiwan, 2008
2. Peter J Ashenden, "The Designers's guide to VHDL",2nd ed, Elsevier science and technology, 1996.
3. Miron Abramovici, Melvin A. Breuer, and Arthur D. Friedman, "Digital Systems Testing and Testable Design," Jaico Publishing House, 2001.

Reference Books:

1. Ming-Bo Lin, "Digital System Designs and Practices: Using Verilog HDL and FPGAs," Wiley India Pvt Ltd , 2012.
2. Charles H. Roth Jr., "Digital System Design using VHDL," Cengage Learning, 2006.
3. Peter J. Ashenden, "Digital Design (Verilog): An Embedded Systems Approach Using Verilog," Morgan Kaufmann; 1 edition, 2007.