Department of Electronics and Communication Engineering
M.M.M. University of Technology, Gorakhpur
(U.P.)

The Overall Credit Structure for PG Programme

Credit Courses			
Postgraduate Core (PC)		**Postgraduate Elective (PE)**	
Category	**credits**	**Category**	**credits**
Maths (M)	4	Program Electives (PE)	16
Program Core (PC)	22		
Minor Project (MP)	4		
Dissertation (D)	18		
Seminar	2		
Total	**50**	**Total**	**16**
Grand Total	**66 (minimum)**		
Audit Courses			
Audit Course (Other Departments) (AC)	6		
Total	**6**		

Credit Structure for M. Tech. in Digital Systems

Category **Semesters**	**I**	**II**	**III**	**IV**	**Total**
Maths (M)	4	-	-	-	4
Programme Core (PC)	13	9	-	-	22
Program Electives (PE)	-	8	8	-	16
Minor Project (MP)	-	-	4	-	4
Dissertation (D)			4	14	18
Seminar (S)	-	-	-	2	2
Total	**17**	**17**	**16**	**16**	**66**

Department of Electronics and Communication Engineering
M.M.M. University of Technology, Gorakhpur (U.P.)

Curriculum for M.Tech (Digital Systems)

Junior year, Semester-I

Sr. No.	Category	Paper Code	Course Name	L-T-P	Credits
1.	M	MAS-102	Advanced Engg. Mathematics	3-1-0	4
2.	PC	MEC-201	Advanced Digital Communication	3-1-2	5
3.	PC	MEC-101A	Advanced Microprocessor	3-0-2	5
4.	PC	MEC-102A	Nano CMOS Design	3-1-0	4
			Audit		
				Total	**18**

Junior year, Semester-II

Sr. No.	Category	Paper Code	Course Name	L-T-P	Credits
1.	PC	MEC-104	Embedded Systems Design	3-1-2	5
2.	PC	MEC-105	Digital Systems Design	3-1-0	4
3.	PE1	MEC-1**		3-1-0	4
4.	PE2	MEC-1**		3-1-0	4
			Audit		
				Total	**17**

Senior year, Semester-III

Sr. No.	Category	Paper Code	Course Name	L-T-P	Credits
1.	PE3	MEC-1**		3-1-0	4
2.	PE4	MEC-1**		3-1-0	4
3.	MP	MEC-120	Minor Project	0-0-8	4
4.	D	MEC-130	Dissertation Part-I	0-0-8	4
				Total	**16**

- Minor Project should be completed during the summer vacation after second semester.

Senior year, Semester-IV

Sr. No.	Category	Paper Code	Course Name	L-T-P	Credits
1.	S	MEC-140	Seminar	0-0-4	2
2.	D	MEC-150	Dissertation Part-II	0-0-28	14
				Total	**16**

Audit Course

S. No.	Course Code	Name of the Course	Prerequisite Subject	L-T-P	Credits
1.	BCS-01	Introduction to Computer Programming	None	2-1-2	--
2.	MCS-206	Information Security and Cyber Laws	None	3-0-0	--
3.	MBA 109	Research Methodology	None	3-0-1	--

Program Elective 1 & Program Elective 2

S. No.	Course Code	Name the Course	Prerequisite Subject	L-T-P	Credits
1.	MEC-202	Advanced Digital Signal Processing		3-1-0	4
2.	MEC-152	Digital Control Systems		3-1-0	4
3.	MEC-153A	Low Power CMOS Circuits		3-1-0	4
4.	MEC-154	Computer Aided Design of Electronics Circuits		3-1-0	4
5.	MEC-155	Data and Computer Communication Networks		3-1-0	4
6.	MEC-156	Digital Integrated Circuits		3-1-0	4
7.	MEC-157	Microcontrollers		3-1-0	4
8.	MEC-158	DSP Processors and Applications		3-1-0	4
9.	MEC-159	RFIC		3-1-0	4
10.	MEC-160	Fundamental of Nanoscale Transistors		3-1-0	4

Program Elective 3 & Program Elective 4

S. No.	Course Code	Name the Course	Prerequisite Subject	L-T-P	Credits
1.	MEC-161	VLSI Testing		3-1-0	4
2.	MEC-162	Artificial Intelligence		3-1-0	4
3.	MEC-163	Neural Networks		3-1-0	4
4.	MEC-164	Virtual Instrumentation		3-1-0	4
5.	MEC-165	Digital Mobile Communication Systems		3-1-0	4
6.	MEC-166	Optoelectronics Devices & Circuits		3-1-0	4
7.	MEC-167	Organic Electronics Devices and Circuits		3-1-0	4
8.	MEC-168	High Speed Devices and Circuits		3-1-0	4
9.	MEC-169*	Introduction & Design of Photovoltaic Systems		3-1-0	4

MEC-201: Advanced Digital Communication (3-1-2)

UNIT I

Overview of Digital Communication: Digital communication system model. Sampling theorem, Communication channels, characteristics and Models, Signal space representations. Digitally modulated signals-Representations. Constellation diagram and design of transmitter and receiver for BPSK,QPSK,M-PSK,16-QAM, FSK, MSK and GMSK and their BER performance analysis in AWGN channel.

UNIT II

Communication Through Band-Limited Linear Filter Channels: Optimum receiver for channels with ISI and AWGN. Linear equalization, Decision feedback equalization, Turbo equalization, Self recovering equalization

UNIT III

Multichannel, Multicarrier Systems and Spread Spectrum Signals: Model of Spread spectrum system. Direct sequence spread spectrum signals. Frequency -Hopped spread spectrum signals. Performance of spread spectrum system in jamming environment, Synchronization of spread spectrum signals.

UNIT IV

Digital Communications through Fading Multipath Channels: Characterization and model. Frequency-Non selective, slowly fading channel, performance analysis of MRC, EGC, SC Diversity techniques over flat fading channel, Digital signalling over a frequency-selective, slowly fading channel, Coded waveforms for fading channel, Multiple access techniques, Capacity of multiple access methods, CDMA, Random access methods.

Experiments:

1. Experiment on QPSK digital Modulation.
2. Experiment on M-ary QAM for different fading channels.
3. Analysis of Bit Error Rate (BER) for BPSK digital Modulation.
4. Analysis of Bit Error Rate (BER) for BFSK digital modulation
5. Analysis of BER for ASK digital modulation.
6. Study of ASK, PSK and FSK digital modulation using MATLAB.

Books & References:

1. John G. Proakis, Digital Communications, 4/e, McGraw-Hill
2. Viterbi, A. J., and J. K. Omura, Principles of Digital Communication and Coding. NY: McGraw-Hill, 1979,ISBN: 0070675163.
3. Marvin K Simon, Sami M Hinedi, William C Lindsey - Digital Communication Techniques –Signal Design & Detection, PHI.
4. MIT OpenCourseWare, Electrical Engineering and Computer Science, Principles of Digital communication II, Spring 2006
5. Aazhang B. Digital Communication Systems (Connexions Web site). January 22, 2004. available at:http://cnx.rice.edu/content/col10134/1.3

MEC – 101A: Advanced Microprocessors (3-1-2)

UNIT-I

16-bit Processors:

Architecture, Signal Description, Physical Memory Organization, Bus–operation, Art of Assembly Language Programming (8086)

UNIT-II

Programmable Peripherals, their working and Interfacing with 8086:

Programmable Peripheral Interface (8255 PPI), USART (8251), 8253/8254 Timer/counter, 8259 Interrupt Controller and 8257 DMA Controller

UNIT-III

32-bit Processors:

Architecture, Addressing Modes, Real and Protected modes, Segmentation, Paging and Cache Management Unit

.

UNIT-IV

Recent Advances in Microprocessors:

Pentium: Salient Features and System Architecture, Branch Prediction, MMX Architecture, Overview of Pentium Pro, Pentium II, Pentium III and Pentium 4

Experiments

1. Group-A : 8 Assembly Language programs based on 8086
2. Group-B : 4 Interfacing based experiments.

- Minimum 8 experiments must be performed during semester. Minimum 6 and 2 experiments should be performed from group-A and group-B respectively

Books & References:

1. AK Ray & MK Bhurchandi: "Advanced Microprocessors and Peripherals" - TMH
2. D.V.Hall, "Microprocessors and Interfacing" TMH
3. B. P. Singh & Renu Singh "Advanced Microprocessor & Microcontroller", New Age Publications.
4. V Rafiquzzaman: "Microprocessors and Applications" TMH

MEC-102A : Nano CMOS Design (3-1-0)

UNIT-I

CMOS Technology, ITRS Roadmap, Nano-CMOS Scaling Problems and Implications: Design Methodology in the Nano-CMOS Era, Innovations Needed to Continue Performance. CMOS Process Technology: n-well, p-well and twin-tub technology, Equipment Requirements for Front-End Processing

UNIT-II

Electrical Behaviour of MOS transistor, SCE, Modelling of MOS transistor using SPICE: Various SPICE parameters, Model using Level-1 or Level-2 or any other advanced Level used by Industry

UNIT-III

CMOS Inverter Design; Supply Voltage Scaling in CMOS Inverters, Power and Area Considerations, Noise Margin, Effect of Threshold Voltage, Doping and Geometry Size on CMOS Switching Behavior

UNIT-IV

Stick Diagrams; Physical Design Rules; Layout Designing; Euler's Rule, Bulk CMOS Design, SOI CMOS Design, PD- and FD-SOI CMOS Design, Solutions for Sub-threshold Leakage, Use of High-k, Leakage in CMOS Nanometric Technology

Books & References:

1. B.G. Streetman & S. Banerjee, "Solid State Electronic Devices", PHI.
2. S.M. Kang & Y. Leblibici, "CMOS Digital Integrated Circuits-Analysis & Design", TMH, Ed.
3. K. Eshraghian & Pucknell, "Introduction to VLSI", PHI
4. A. P. Chandrasekaran and R.W. Broadersen, "Low Power Digital CMOS Design", Wiley
5. B. Razavi, "Design of Analog CMOS Integrated Circuits", TMH.
6. Research Papers from IEEE Transactions on Electron Devices, and Other Reputed Journals

MEC – 104: Embedded Systems Design (3-1-0)

UNIT-I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Applications

UNIT-II

Embedded Processor: Devices & Architecture of 8051/89C51 Motorola, PIC, AVR, etc., Review of memory Architecture, I/ O, Timer/ Counter & Interrupts

UNIT-III

RTOS Based Embedded & Task Communication: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS

UNIT-IV

Design &Tools: Design of an embedded application, Examples / Case Study

Experiments:

1. Embedded programming on 6713, TMS 320C6713/32 Embedded Trainer Kit
2. Embedded programming on 5410/16, TMS 320VC5410/16 Embedded Trainer Kit

Books & References:

1. Real-Time Systems and Programming Languages -Burns, Alan and Wellings, Andy, 2e, (Addison-Wesley Longman), 1997
2. An Introduction to real time systems: Design to networking with C/C++ - Raymond J.A. Bhur and Donald L. Bialey (Prentice Hall), 1999
3. Real time Programming: A guide to 32 Bit Embedded Development- Grehan Moore, and Cyliax (AddisonWesley-Longman), 1998
4. "Embedded Systems Design" – Heath, Steve(Newnes), 1997
5. Embedded System Design: A Unified Hardware /Software Introduction – Frank Vahid and Tony Givargis, Wiley 2001

MEC– 105: Digital System Design (3-1-0)

UNIT-I

Introduction: Number System & Codes, Combinational logic circuits, Flip-Flops and related devices Digital Arithmetic operations and circuits counters and registers.

UNIT-II

Integrated Circuit Logic family: Digital I.C. Terminology, TTL, ECL, MOS/CMOS logic families, IC interfacing, TTL driving CMOS & Vice Verso Low voltage Technology.

MSI Logic Circuits: Decoders/drivers, Encoders, Multiplexers, De-multiplexers, Magnitude Comparators, applications of MSI logic ICs.

UNIT-III

Memory Devices: General memory operations, Programmable logic devices, Semi-conductor memories, SRAM, DRAM, expanding word size and capacity, special memory functions

UNIT-IV

Introduction to Microprocessor & Micro-Computers:

Alphanumeric display devices, LCD and CRT Displays, Applications of programmable logic devices.

Books & References:

1. R.J. Tocci: "Digital System: Principles & Applications" – PHI
2. Manufacturers IC – Data Sheet.

MEC-202: Advanced Digital Signal Processing (3-1-0)

UNIT-I

Basics of Multirate systems and its application, up sampling and Down - Sampling, Fractional Sampling rate converter. Polyphase decomposition. Efficient realisation of Multirate systems.Uniform filter banks and it's implementation using polyphase decomposition.

UNIT-II

Two channel Quadrature Mirror Filter Banks, Perfect Reconstruction, M-channel PR QMFB.Time Frequency Analysis, Heisenberg's uncertinity principle. Short time fourier transform - Gabor transform. Continous Wavelet Tranform and it's properties. Multi Resolution Analysis, Discrete Wavelet Transform, Orthonormal Wavelet Analysis - Filterbank interpertation. Haar and Daubechise wavelets, Bi-orthogonal wavelets and Filter bank interpretation

UNIT-III

B-Spline wavelets, Wavelet packets.2D wavelt transforms. Application of wavelet tranform for data compression, noise reduction. Linear Prediction -Forward and Backward Prediction - Levinson-Durbin Algorithm, Schur Algorithm

UNIT-IV

Power spectrum estimation of signals: Wide Sense Stationary Random Processes. Power spectral density. Non parametric methods: periodogram,Backman-Tuckey method. Parametric method: ARMA, AR processes, Yule-Walker method

Books & References:

1. P. P. Vaidyanathan, Multirate Systems and Filterbanks, Prentice Hall
2. Wavelet Transforms - Bopadikar and Rao, Pearson Education
3. Insight into wavelets, K. P. Soman, Prentice Hall India
4. Digital signal Processing, By John G. Proakis, Dimitris G. Manolakis, Pearson Education

MEC-152: Digital Control System (3-1-0)

UNIT-I

Sampling Process & Control System: A/D & D/A conversion, Discrete System Modeling using Z-transform.

Discrete Control System Analysis Stability, Error-analysis, Bilinear Transformation, Frequency Response

UNIT- II

Discrete Transform Approximations: Folding Aliasing, Transformations method (s,z and, w) Numerical Solution of Difference Equations.

Implementing Digital Control System: Control Logic, Software, Data flow Diagram, Real Time Design for Digital, Control. Real Time Scheduling

UNIT-III

Compensator Design: Cascade Compensation using Digitization Technique and Direct Techniques, Feedback Compensation Techniques, Software for Digital Controllers.

Basics of Modern Discrete Control Theory: System Structure, Controllability, Observability & State -Space stability.

UNIT-IV

Discrete Optimal Control: Optimal Control Concepts, Maximum Principle, Discrete Linear Regulator, Sampling Time.

Books & References:

1. C. H. Houpis, Gray B. Lamont: "Digital Control Systems" – McGraw-Hill.
2. I.J. Nagrath, M. Gopal: "Control System Engineering" – New Age Publications

MEC-153: Low Power CMOS Circuits (3-1-0)

UNIT-I

Basics of MOS circuits: MOS Inverters, MOS Combinational Circuits - Different Logic Families, Static & Dynamic Circuits

UNIT- II

Combinational Logic Designs using CMOS, Emerging low power approaches, Design using CMOS TG, Calculations of Delay & Power Dissipation of CMOS inverter Circuits

UNIT-III

Dynamic Logic Circuits: Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Dynamic CMOS Circuit Techniques: Dynamic Dissipation in CMOS, High Performance CMOS Circuits: Domino & NORA CMOS Logic.

UNIT-IV

Circuit Techniques for Dynamic Power Reduction: Approaches for Power Reduction, Dynamic Power Consumption Component, Circuit Parallelization, and Voltage Scaling based Circuit Techniques

Memory Design: SRAM & DRAM Cells, Noise Margin Calculations, Full CMOS SRAM Cells: Leakage Currents, Read/Write operations

Books & References:

1. S.M. Kang & Y. Leblibici, "CMOS Digital Integrated Circuits-Analysis & Design", TMH, Ed.
2. K. Eshraghian&Pucknell, "Introduction to VLSI", PHI.
3. A.P.Chandrasekaran and R.W.Broadersen, "Low Power Digital CMOS design", Wiley
4. Christian Piguet, "Low Power CMOS Circuit: Technology, Logic Design & CAD Tools", Taylor & Francis
5. Gary Yeap, "Practical Low Power Digital VLSI design", Kluwer
6. J.M. Rabaey, "Digital Integrated Circuits-A Design Perspective", PHI

MEC-154: Computer Aided Design of Electronic circuits (3-1-0)

UNIT-I

Modelling analogies, and their role, Introduction to general purpose analog computer and its applications in simulation of linear and non-linear systems, CAD Tools, Importance of SPICE simulation, Introduction to HDL and verilog

UNIT-II

Modelling & Simulation of Semiconductor Devices to predict its electrical behaviour, SPICE parameter of MOS and BJT, Simulation of MOS and BJT based circuits

UNIT-III

Digital Computer Simulation of Electrical and Electronic Circuits, Application of HDL and verilog for digital circuit simulation, Verification mechanism in design flow

UNIT-IV

Various CAD tools for front end and back-end design, CAD tools for layout generation, CAD tools for testing and verification of ICs

Books & References:

1. Neil Weste: "Principle of CMOS Design" – Addison Wesley
2. Rashid: "Spice for Circuits of Electronics using PSpice"– Prentice-Hall
3. Banafsheh Rezaeian, "Simulation and Verification Methodology of Mixed Signal Automotive ICs" November 22, 2012

MEC – 155: Data and Computer Communication Networks (3-1-0)

UNIT-I

LAN Networking & Data Transmission Protocols: IP, IPX, Apple-Talk, Ethernet, FDDI, Token Ring, Wireless 802.11b

WAN Digital Transmission Technologies: T-Carrier, SONET, Frame Relay ISDN, Global Cellular.

UNIT-II

Design & Implementation of Enterprise- Networks.

Routers & Switches (including ATM Switches), Router configuration Multiprotocol Network Traffic Routing in PDN & Internet Enviroments.

UNIT-III

Network Performance Measurement & Trouble Shooting Concepts : including SNMP.

UNIT-IV

Cellular Mobile Computer Communication: GSM Technology, NA-TDM, PCN VoIP/FoIP & SMS, CISCO's IGRP /EIGRP, ACL NAT, TUNNELING & IOS basics.

Satellite Links & Broad Band ISDN Network.

Books & References:

1. M James Martin: "Understanding the Network" – Techmedia Publications.
2. William Stallings: "Data & Computer Communication" – Pearson Education
3. William C. Y. Lee: "Mobile Cellular Tele Communication" – McGraw Hill

MEC-156: Digital Integrated Circuits (3-1-0)

UNIT-I

Semiconductor Components of Digital Integrated Circuits: Modelling of PN Junction Diodes, BJTs, and MOSFETs, Model Parameter Extraction of these devices

UNIT-II

BJT Inverters DC and Switching Characteristics, Schottky Transistor Specifications of Logic Circuits, Qualitative discussion on TTL Circuits, Standard TTL Circuits, Advanced TTL Circuits, I-square L Technology, Edge triggered D-F/F, I-square L-Condition for Proper Operation, Schottky Transistor Logic, Stacked I-square L, ECL Basic Operation

UNIT-III

nMOS Logic Circuits, nMOS inverters; CMOS inverters, MOS NAND,NOR and Other Gates: Clocked CMOS, Dynamic CMOS, Transmission Gates; Realization Of MUX, decoder, D-F/F BiCMOS Gates, BiCMOS Driver

UNIT-IV

Memories: Types of Memory, Static and dynamic Memories, BiCMOS SRAM-DRAM, CMOS and BiCMOS ROM-EPROM,EEPROM and Flash EPROM

Books & References:

1. Digital Integrated Circuits By Rabaey, Jan, Anantha Chandrakasan, and Bora Nikolic, Prentice Hall Publications.
2. CMOS Digital Integrated Circuits By Kang and Leblebici, TMH Publications

MEC-157: Microcontrollers (3-1-0)

UNIT-I

Introduction to Embedded Systems: Overview of Embedded System Architecture, Application areas, Categories of embedded systems, specialties of embedded systems. Recent trends in embedded systems. Brief introduction to embedded microcontroller cores CISC, RISC, ARM, DSP and SoC

UNIT-II

8051 Microcontroller: Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts.

UNIT-III

Assembly Language Programming of 8051: Instruction set, Addressing modes, Development tools, Assembler Directives, Programming based on Arithmetic & Logical operations, I/O parallel and serial ports, Timers & Counters, and ISR

UNIT-IV

Advanced Microcontrollers: AVR, MCS-96 and ARM Microcontrollers: Important Features, Pins and Signals Description, Architectures, memory organization etc.

Books & References:

1. The 8051 microcontroller & Embedded systems, M. A. Mazidi, J. G. Mazidi, R. D. McKinlay, Pearson
2. The 8051 microcontroller & Embedded systems, Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learning
3. Embedded / real – time systems: concepts, design & programming, Black Book, Dr. K. V. K. K. Prasad, Dreamtech press, Reprint edition 2013
4. Introduction to embedded systems, Shibu K. V., McGraw

MEC – 158: DSP Processors and Applications (3-1-0)

UNIT-I
Review of DSP fundamentals
Issues involved in DSP processor design – speed, cost, accuracy, pipelining parallelism, Quantization error, etc.

Unit-II
Key DSP hardware elements – Multiplier, ALU, Shifter, Address generator, etc.
DSP Processor and Architecture – Texas, ADSP and Motorola DSP chips, Architecture, Instruction sets.

UNIT-III
Software development tools – Assembler, Linker, and Simulator.

UNIT-IV
Applications using DSP processors – Spectral analysis, FIR / IIR filters, Linear Predictive Coding, Imaging, Instrumentation, etc.

Books & References:

1. K Padmanabhan, S Ananthi & RV Rajeshwaran: "Practical Approach to Digital Signal Processing"
2. TMS Data Manual
3. ADSP Data Manual
4. Motorola Data Manual
5. Rabiner LR & Gold B: "Theory and Application of Digital Signal Processing" – PHI, 1996.

MEC – 159: RFIC (3-1-0)

UNIT-I

Introduction to RF and Wireless Technology: Complexity comparison, Design bottle necks, Applications, Issues in RF Design: Noise, Linearity and Signals

Unit-II

Basics of LNA technologies, LNA topologies, CS stage with inductive load, Resistive feedback, Alternative LNA technologies, layout of cascade devices

UNIT-III

Mixers and Oscillators: General Considerations and Performance Parameter of Mixer circuit, Up & Down Conversion Mixers, Cascaded Stages, oscillators, Frequency synthesizers

UNIT-IV

Power Amplifiers: General considerations, Classification, High Frequency Power Amplifiers, large signal impedance matching, linearization techniques.
On-chip Passive Devices and integrated passive devices used in RF transceiver design

Books & References:

1. Behzad Razavi, RF Microelectronics Prentice Hall of India, 2001.
2. Thomas H. Lee, The Design of CMOS Radio Integrated Circuits, Cambridge University Press
3. John W. M. Rogers and Calvin Plett, " Radio Frequency Integrated Circuit Design" Second Edition, Artec House Publication

MEC – 160: Fundamental of Nanoscale Transistors (3-1-0)

UNIT-I

Basic Concepts: Distribution functions.1D, 2D, and 3D Carriers, Density of states and carrier densities, Diffusive and Ballistic transport, The NEGF formalism, Scattering theory of MOSFET.

Unit-II

Introduction to MOSFET,1D and 2D MOS Electrostatics, Current-Voltage characteristics of MOSFET, Physical view of the nanoscale MOSFETs, The ballistic MOSFET, Ballistic MOSFET under nondegenerate and degenerate conditions.

UNIT-III

Nanowire Field Effect Transistors: Introduction, Silicon nanowire MOSFETs, The I-V characteristics for nondegenerate and degenerate carrier statistics, Carbon nanotubes, Carbon nanotube MOSFETs and its characteristics.

UNIT-IV

Introduction to Graphene Nanoribbons Field Effect Transistors(GNRFETs), Transfer and output characteristics of GNRFETs, Introduction to Transition Metal DichalcogenidesField Effect Transistors(TMDFETs),Transfer and output characteristics of TMDFETs.

Books & References:

1. Mark S. Lundstrom, Nanoscale Transistors, Springer.
2. SupriyoDatta, Lessons fromNanoelectronics: A New Perspective on Transport—Part A: Basic Concepts, 2nd Ed, World Scientific Publication.
3. Website for Online Video "www.nanohub.org"

MEC-161 VLSI Testing (3-1-0)

UNIT-I
Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends Affecting Testing

UNIT-II
Techniques for Testing Chips, Types of Testing, Automatic Test Equipment, Multi-Site Testing, Electrical Parametric Testing

UNIT-III
Test Economics, Defining Costs, Production, Benefit-Cost Analysis, Economics of Testable Design, Yield, Defect Level as a Quality Measure

UNIT-IV
Test Data Analysis, Defect Level Estimation, Defects, Errors, and Faults, Functional Versus Structural Testing, Fault Models

Books & References:

1. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing", Kluwer Academic Publishers, 2000.
2. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems Testing and Testable Design", Wiley-IEEE Press, 1993.
3. N.K. Jha and S. Gupta, "Testing of Digital Systems", Cambridge University Press, 2004
4. L. T. Wang, C-W. Wu and X. Wen, "VLSI Test Principles and Architectures", Morgan Kaufman Publishers, 2006
5. P.H. Bardell, W.H. McAnney and J. Savir, "Built-in Test for VLSI: Pseudorandom Techniques", Wiley Interscience, 1987

MEC-162: Artificial Intelligence (3-1-0)

UNIT-I

The concept of AI, Approaches to AI, Brief History of AI, An overview of AI, Introduction to Artificial Neural Networks, ES

UNIT-II

Reactive Machines: Perception and Action, Representing and Implementing Action Functions, ANN Models, Gradient Decent Methods, The Widrow-Hoff Procedure, Generalized Delta Rule, Back Propagation, Hopefield and Kohenen's Net

UNIT-III

Search in State Spaces: State space approach, State Space Graph, Depth First, Breadth First Search, Iterative Deepening, Backtracking, Heuristic Search, A* algorithm, Heuristic Functions and Search Efficiency, Approximate Searches, Learning Heuristic Functions

UNIT-IV

Fuzzy Logic: Fuzzy Sets, Fuzzy operations,Membership functions, Fuzzification, Fuzzy decision making, Fuzzy classification, clustering, c- means algorithm, Genetic Algorithm

Books & References:

1. Nilson N J: "Artificial Intelligence: A new synthesis" – Morgan Kaufmann Publishers, 1998
2. Timothy J Ross: "Fuzzy Logic with Engineering Applications" – MGH, 1995
3. Rich E, and Knight K: "Artificial Intelligence" – MGH, 1992
4. Patterson, D W: "Introduction to AI and Expert Systems" – PHI, 1992
5. George J Klir, Bo Yuan: "Fuzzy Sets and Fuzzy Logic Theory and Applications" – PHI, 1995
6. B. Yegnanarayana: "Artifical Neural Networks" – PHI

MEC-163: Neural Networks (3-1-0)

UNIT-I

Neural networks characteristics, History of development in neural networks principles, Artificial neural net terminology, Model of a neuron, Topology, Learning, types of learning, Supervised, Unsupervised and Reinforcement learning, Knowledge representation and acquisition.

UNIT-II

Basic Hop field model, Basic learning laws, Unsupervised learning, Competitive learning, K-means clustering algorithm, Kohonen`s feature maps.

UNIT-III

Radial basis function neural networks, Basic learning laws in RBF nets, Recurrent back propagation, Introduction to counter propagation networks, CMAC network, and ART networks.

UNIT-IV

Applications of neural nets such as pattern recognition, Optimization, associative memories, speech and decision making. VLSI implementation of neural networks

Books & References:

1. J.M. Zurada: “Introduction to artificial neural systems”- Jaico Pub,2009
2. Simon Haykin : “Neural Networks”- PH, 1999

MEC-164: Virtual Instrumentation (3-1-0)

UNIT-I

Historical perspective, advantages, Block diagram, Architecture o f a Virtual Instrument, Data Flow Techniques, Graphical programming in data flow, comparison with Conventional programming

UNIT-II

VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O

UNIT-III

ADC, DAC, DIO, counters & timers, PC Hardware structure, timing, Interrupts DMA, software and hardware installation.

UNIT-IV

Current loop, RS 232C/ RS485, GPIB, System buses, interface buses: USB, PCMCIA,VXI, SCXI, PXI, etc., networking basics for office & Industrial applications, VISA and IVI, Image Acquisition and Processing. Motion control

Books & References:

1. Jerome, Jovitha: "Virtual Instrumentation and LABVIEW", PHI Learning, New Delhi, 1st Edition, 2010
2. Sanjay Gupta and Joseph John: "Virtual Instrumentation Using Lab View", Tata McGraw Hill, New Delhi,1st Edition, 2008
3. Ronald W. Larsen: "LabVIEW for Engineers", Prentice Hall Ltd, USA Jan 2010
4. LabVIEW: Basics I & II Manual, National Instruments, 2005

.

MEC-165: Digital Mobile Communication System (3-1-0)

UNIT-I
TDMA, classical ALOHA, Slotted ALOHA, Carrier Sense Multiple Access, Demand Assigned Multiple Access

UNIT-II
Spread Spectrum Techniques: Introduction, Fundamental Concepts, pseudo noise sequences, CDMA, FHSS, DSSS, Synchronization of Spread Spectrum, Spread Spectrum applications in cellular communication, PCs, and mobile communication

UNIT-III
GSM: Mobile Services, System Architecture, Radio interface, Protocols, localization and calling, Handover, Security, and New Data Services

UNIT-IV
Electronic navigation & surveillance Systems, Blue tooth, GPS, Global Mobile Satellite Systems

Books & References:

1. Dr. Kamilo Feher: "Wireless Digital Communications", PHI
2. Jochen Schiller: "Mobile Communications", Pearson Education
3. Raj Pandya: "Mobile and Personal Communication Systems and Services", IEEE Press, PHI

MEC-166: Optoelectronic Devices & Circuits (3-1-0)

UNIT-I

Elemental and Compound Semiconductor, Electronic Properties of Semiconductor: Carrier Effective masses and band structure, effect of temperature and pressure on bandgap, Carrier scattering phenomena, conductance processes in semiconductor, bulk and surface recombination phenomena

UNIT-II

Optical Properties of Semiconductor, EHP formation and recombination, absorption in semiconductors, Effect of electric field on absorption, absorption in quantum wells, radiation in semiconductors, deep level transitions, Augur recombination

UNIT-III

Junction theory, Schottky barrier and ohmic contacts, semiconductor hetero junctions, LEDs, Photo detectors, Solar Cells

UNIT-IV

Optoelectronics modulation and switching devices: Analog and Digital modulation, Franz-Keldysh and Stark effects modulators, Electro-optic modulators.
Optoelectronics Integrated Circuits (OEICs): Need for hybrid and monolithic integration, OEIC transmitters and receivers

Books & References:

1. Pallab Bhattachrya: "Semiconductor Optoelectronic Devices", Prentice Hall Publications, 1997
2. S.M. Sze, "Physics of Semiconductor Devices", Wiley Publications, 2000

MEC-167: Organic Electronics Devices and Circuits (3-1-0)

UNIT-I

Organic Materials and Device Physics:

Introduction; Organic Materials: Conducting Polymers and Small molecules, Organic Semiconductors: p-type and n-type semiconductors, Source, Drain and Gate Electrodes, Gate Dielectrics, Substrate; Concept of Charge Transport in Organic Semiconductors; Energy Band Diagram; Comparison between Organic and Inorganic Semiconductors including the Merits, Demerits and Limitations

UNIT-II

Organic Thin Film Transistors (OTFTs) and Modeling of Organic Devices:

Introduction; Operating Principle; Classification of Various OTFT Structures; Output and Transfer Characteristics; Performance Parameters; Extraction of Performance Parameters, Impact of Structural Parameters on Behavior of OTFT; Merits, Demerits and Limitations of Organic Devices;

Effect of Self Assemble Monolayer (SAM); Different OTFT Models; Stability Issues, Future Scope. Various Defects and Effects in Organic Devices; Modeling of OTFT Structures; Concept of Contact Resistance: Origin of Contact Resistance, Contact Resistance Extraction, Analysis and Performance Parameters Comparison of OTFT structures; Single Gate (SG) and Dual Gate (DG) OTFT Performance Comparison

UNIT-III

Organic Light Emitting Diodes (OLEDs) and Organic Solar Cells:

OLED: Introduction; Organic Materials for OLEDs; Classification of OLEDs, Operating Principle; Output and Transfer Characteristics; Analysis of OLED Performance: Optical, Electrical and Thermal properties, Merits and Demerits; Stability Issues; OLEDs as display Applications.

Organic Solar Cell: Introduction; Materials for organic Solar Cells; Operating Principle; Characteristics, Applications and Future Scope.

UNIT-IV

OTFT Applications:

Organic Digital Circuits: All *p*-Type, Hybrid Complementary Inverters, Fully Organic Complementary Inverter Circuits and Their Comparison; Logic Circuit Implementation.

Organic Memory: Organic Static Random Access Memory (OSRAM) and other Important Organic Memory Designs.

Books & References:

1. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley-VCH Verlag Gmbh & Co. KGaA, Germany, 2006
2. Klaus Mullen, Ullrich Scherf, Organic Light Emitting Devices: Synthesis, Properties and Applications, Wiley-VCH Verlag Gmbh & Co. KGaA, Germany, 2005

3. Hagen Klauk, Organic Electronics II: More Materials and Applications, Wiley-VCH Verlag Gmbh & Co. KGaA, Weinheim, Germany, 2012
4. Flora Li, Arokia Nathan, Yiliang Wu, Beng S. Ong, Organic Thin Film Transistor Integration: A Hybrid Approach, Wiley-VCH, Germany; 1st Ed., 2011
5. Wolfgang Brutting, Physics of Organic Semiconductors, Wiley-VCH Verlag Gmbh & Co. KGaA, Germany, 2005
6. IEEE Transaction on Electronic Devices, Organic Electronics Devices and Circuits based Thesis

MEC-168: High Speed Devices and Circuits (3-1-0)

UNIT-I

Introduction to Basic Concepts, Requirements of High Speed Devices, Circuits & Materials Semiconductors, Ternary Compound Semiconductor and their Application, Crystal Structures in GaAs, Dopants and impurities in GaAs and InP

UNIT-II

Brief Overview of GaAs Technology for High Speed, GaAs and InP Devices for Microelectronics, Ohmic Contacts on Semiconductors, Fermi Level Pinning & Schottky Barrier Diodes

UNIT-III

Metal Semiconductor contacts for MESFET, MESFET Operation & I-V Characteristics

UNIT-IV

Hetero Junctions & HEMT, HEMT 1-V Characteristics and Transconductance, SiGe Technology, SiGe HBT

Books & References:

1. S.M. Sze, "High Speed Semiconductor Devices", Wiley
2. Michael Shur, "GaAs Devices and Circuits", Plenum Press
3. C.Y. Chang and F. Kat, "Gallium Arsenide High Speed Devices: Physics Technology and Circuit Applications", Wiley
4. H. Beneking, "High Speed Semiconductor Devices: Circuit Aspects and Fundamental Behavior", Chapman and Hall, LONDON

MEC-169: Introduction & Design of Photovoltaic Systems (3-1-0)

UNIT-I

Evolution of the Photovoltaic cell, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open Circuit and peak power parameters, Cell efficiency, Effect of temperature, Fill factor, General design tools used for PV cell.

UNIT-II

Series and Parallel Interconnection: Identical and Non-identical cells in series and parallel, Protecting cells in series and parallel. Energy From Sun: Insolation and irradiance, Solar geometry, Sunrise and sunset hour angles. Incident Energy Estimation: Energy on a tilted flat plate, Atmospheric effects, Air Mass, Energy with atmospheric effects, and Clearness index.

UNIT-III

Sizing of PV cell: Sizing PV for applications without batteries, Batteries - Capacity, C-rate, Efficiency, Battery selection, Batteries in series and parallel configurations. PV system design-Load profile, Days of autonomy and recharge, Battery size, PV array size, MPPT concept, MPPT algorithms, PV-Battery Interfaces: Direct PV-battery connection, Charge controller.

UNIT-IV

Peltier device-principle, Peltier element, Peltier cooling, Thermal aspects- Conduction, Convection, A peltier refrigeration example. PV and Water Pumping: Water pumping principle, Hydraulic energy and power. PV-Grid Interface:Grid connection principle, PV to grid topologies, AC to DC transformations, DC to AC transformations.

Books & References:

1. Augustin M C Evoy, Tom Markvart, Luis Castañer "Practical Handbook of Photovoltaics Fundamentals and Applications," 2nd Edn. Elesvier.
2. Chenming, H. and White, R.M., Solar Cells from B to Advanced Systems, McGraw Hill Book Co, 1983
3. Ruschenbach, HS, Solar Cell Array Design Hand Varmostrand, Reinhold, NY, 1980
4. Proceedings of IEEE Photovoltaics Specialists Conferences, Solar Energy Journal.