Course Structure & Syllabus for the programs:

Master of Technology in Electronics Engineering

(As per the Ordinances for Master of Technology as per 6th Academic Council)

Approved by

Board of Studies

Submitted By

Department of Electronics Engineering,

Harcourt Butler Technical University,

Nawabganj, Kanpur-208002 (UP)

VISION AND MISSION OF THE DEPARTMENT

Vision

Department of Electronics Engineering aims to deliver Technical Education in the field of Electronics and Communication Engineering, for producing Engineers and Technologists who are happy, healthy and competent professionals, motivated to serve the society through research & innovation.

Mission

1. To educate and train the students with state-of-the-art in Electronics and Communication Engineering.
2. To prepare the students who are fit for meeting the requirements and challenges of the Industry right at the time of their graduation by evolving a sustainable Industry-University interaction system for this.
3. To upgrade the teaching standards through continued efforts toward improvement of the qualification and expertise of the teachers as well as supporting staff.
4. To create awareness amongst the students towards socio environmental technologies by offering related courses and organizing seminars/workshops on these topics in the university and by encouraging participation in similar activities at other places.
5. To expand research and development activities in the frontier areas related to Electronics and Communication.
6. To include the aspect of integration of environmental balance and human values in the curriculum.
7. To provide academic support to other technical institutions at state & national level through the process of networking.
8. To start social service programs like education for masses, particularly using the enhanced means of communication.

VISION AND MISSION OF THE UNIVERSITY

VISION

"To achieve excellence in technical education, research and innovation".

MISSION

1. Imparting Knowledge to develop analytical ability in science and technology to serve the industry and society at large.
2. Equip and enable students with conceptual, technical and managerial skills to transform the organization and society.
3. Inculcating entrepreneurial philosophy and innovative thinking to promote research, consultancy and institutional social responsibility.
4. Serving people, society and nation with utmost professionalism, values and ethics to make development sustainable and quality of life.

Program Educational Objectives (PEOs)

Program graduates, within three years from their graduation will

PEO 1: have knowledge of basic and applied sciences, so as to apply the necessary competence for technically sound, economically feasible and socially acceptable solutions of real life complex engineering problems.

PEO 2: be fit for meeting the requirements and challenges of industries, research and academic institutions both at the national and International level, by applying expertise gained in area of electronics and communication engineering.

PEO 3: be professionally competent with excellent communication and management skills along with being enterprising professionals and responsible citizens capable of delivering their services individually as well as in a collaborative framework.

Structure of the Curriculum
Semester Wise Course Structure & Evaluation Scheme
For M.Tech. in Electronics & Communication Engineering

I Semester

Sr. No	Course Type	Subject code	Course title	Credits	Sessional Marks				ESM	Total Marks
					MSE	TA	Lab	Total		
1.	PCC	EET-551	Introduction to Signal Analysis	5(3-2-0)	30	20	-	50	50	100
2.	PCC	EET-553	Advanced Semiconductor Devices	5(3-2-0)	30	20	-	50	50	100
3.	PCC	EET-555	Neural Network	4(3-1-0)	30	20	-	50	50	100
4.	PCC	EET-557	Estimation and Detection Theory	4(3-1-0)	30	20	-	50	50	100
Total Credits				18						

II Semester

Sr. No	Course Type	Subject code	Course title	Credits	Sessional Marks				ESM	Total Marks
					MSE	TA	Lab	Total		
1.	PCC	EET-552	Digital Communication	4(3-1-0)	30	20	-	50	50	100
2.	PCC	EET-554	Optical Communication	4(3-1-0)	30	20	-	50	50	100
3.	PEC	EET-	PEC-1	4(3-1-0)	30	20	-	50	50	100
4.	PEC	EET-	PEC-2	4(3-1-0)	30	20	-	50	50	100
Total Credits				16						

III Semester

Sr. No	Course Type	Subject code	Course title	Credits	Sessional Marks				ESM	Total Marks
					MSE	TA	Lab	Total		
1.	PCC	EET-651	Advanced Digital Signal Processing	4(3-1-0)	30	20	-	50	50	100
2.	PEC	EET-	PEC-3	4(3-1-0)	30	20	-	50	50	100
3.	Seminar	EET-695	-	2(0-0-4)	-	50	-	50	50	100
4.	Dissertation	EET-697	-	4(0-0-8)	-	50	-	50	50	100
Total Credits				14						

IV Semester

Sr. No	Course Type	Subject code	Course title	Credits	Sessional Marks				ESM	Total Marks
					MSE	TA	Lab	Total		
1.	Dissertation	EET-698	-	12(0-0-24)	-	50	-	50	50	100
Total Credits				12						

Elective-I (PEC-1)

Sl. No.	Course Code	Name of the course	Credit (L-T-P)
1.	EET-556	Space Communication	4(3-1-0)
2.	EET-558	Organic Electronics	4(3-1-0)
3.	EET-560	RF Systems	4(3-1-0)
4.	EET-562	Digital System Design	4(3-1-0)
5.	EET-564	Advanced Microprocessor	4(3-1-0)
6.	EET-566	Communication Theory	4(3-1-0)
7.	EET-568	Analog VLSI Circuits	4(3-1-0)

Elective-II (PEC-2)

Sl. No.	Course Code	Name of the course	Credit (L-T-P)
1.	EET-570	Antenna Analysis & Synthesis	4(3-1-0)
2.	EET-572	VLSI System Design	4(3-1-0)
3.	EET-574	Wireless Communication	4(3-1-0)
4.	EET-576	Information Theory & Coding	4(3-1-0)
5.	EET-578	Architecture & Applications of Digital Signal Processors	4(3-1-0)
6.	EET-580	Embedded Systems	4(3-1-0)

Open Elective (PEC-3)

Sl. No.	Old Course Code	Name of the course	Credit (L-T-P)
1.	EET-653	Telecommunication & Switching	4(3-1-0)
2.	EET-655	Image Processing	4(3-1-0)
3.	EET-657	Data Communication Networks	4(3-1-0)
4.	EET-659	Fuzzy Electronics	4(3-1-0)
5.	EET-661	Photonic Networks	4(3-1-0)
6.	EET-663	VLSI Implementation of Digital Processors	4(3-1-0)
7.	EET-665	Mobile Communications	4(3-1-0)

Table (a) Program curriculum grouping based on course components

Course Component	**Curriculum Content (% of total Credits of the program)**	**Total number of credits**
Program Core Courses(PCC)	30	63
Program Electives Courses (PEC)	12	14
Seminar (S)	02	14
Dissertation (D)	16(04+12)	2+2 = 4
Total	60	

Table (b) Program curriculum grouping based on course components as per semester:
Frequency & Credits

Sem	**PCC**		**PEC**		**Seminar**		**Dissertation**		**Total**
	Credits	No.	Credits	No.	Credit	No.	Credit	No.	Credit
I	5+4+5+4=18	4	-	-	-	-	-	-	18
II	4+4=08	2	4+4=08	2	-	-	-	-	16
III	4	1	4	1	2	1	04	01	14
IV	-	-	-	-	-	-	12	01	12
Tot	**30**	**07**	**12**	**3**	**02**	**1**	**16**	**1**	**60**

1st Semester

PCC(old code:EET-501)	INTRODUCTION TO SIGNAL ANALYSIS	3L:2T:0P	5 credits

Course Outcome:

On completion of the course, student will be able to:

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear time invariant system and understand the convolution operator and Fourier transforms for continuous and discrete time system.
3. Understand the Sampling and recover the original signal from its samples.
4. Understand the concepts of vector space, basis and linear independent and to understand the concept of eigen vectors and eigen values.
5. Develop the ability to represent band pass signals and to understand baseband transmission through band limited channels. To understand the basics of modulation and detection techniques.

Syllabus

Discrete and Continuous time signals and systems, LTI systems, Convolution, Difference equations. Frequency domain representation: Fourier transform and its properties. Random discrete signals. Sampling and reconstruction: Change of sampling rate. Normed vector spaces, basis, linear independence, orthogonality. Linear systems of equations. Over and Under-determined systems. Row- and Column spaces, Null spaces. Least square and minimum norm solutions. Inverse and pseudo inverse, Symmetry transformations. Eigenvectors and eigenvalues. Hilbert transforms, band pass representations and complex envelope. Base band pulse transmission, matched filtering, ISI, equalization. Coherent and non-coherent detection. Image as a Signal, Sampling of Image, Signal Analysing using Wavelet Transform, spatio temporal signal

References:

1. Oppenheim Schafer, “Discrete-Time Signal Processing”. TMH
2. Gilbert Strang, “Linear Algebra and its Applications”, Thomson
3. John G. Proakis, Masoud Salehi, “Communication Systems Engineering”, Pearson Education.
4. Simon Haykin, “Communication Systems”, Wiley India.
5. Lectures of NPTEL.

PCC	Estimation and Detection Theory	3L:1T:0P	4 credits

Course outcomes:

On completion of the course, student will be able to:

1. Acquire basics of statistical decision theory used for signal detection and estimation.
2. Examine the detection of deterministic and random signals using statistical models.
3. Comprehend the elements and structure of nonparametric detection.
4. Examine the performance of signal parameters using optimal estimators.
5. Analyze signal estimation in discrete-time domain using filters.

Syllabus

The Bayesian Philosphy ,Priori knowledge and estimation, choosing a priori PDF, Bayesian linear model, Nuisance parameters, Bayesian estimations for deterministic parameters, General Bayesian estimators; Risk Function, Minimum mean square estimator, Maximum A posteriori estimator , Linear Bayesian Estimator: Linear MMSE Estimation, Geometrical Interpretation; Detection Theory; composite hypothesis testing and its approaches, Performance of GLRT for large data records, equivalent large data records tests, locally most powerful detectors, Multiple hypothesis testing, Asymptotically equivalent test(no nuisance and nuisance parameters); deterministic signals with unknown parameters; signal modeling and detection parameters, unknown amplitude and unknown arrival time; sinusoidal detection; Random signals with unknown parameters: Incompletely known signal covariance, Large data records approximations, weak signal detection; unknown noise parameters: General considerations ,white Gaussian noise; colored WSS Gaussian noise; Kalman filters: Dynamical signal models. Scalar Kalman Filter, Kalman vs Weiner Filter, Vector Kalman filter derivation, Extended Kalman filter derivation

Essential Reading:

1. S.M. Kay, “Fundamental of Statistical Signal Processing: Estimation Theory”, Vol-I, Prentice Hall PTR, 2009

2. S.M. Kay, “Fundamental of Statistical Signal Processing: Detection Theory”, Vol-II, Prentice Hall PTR, 1998

Supplementary Reading:

1. H.V. Poor, “An Introduction to Signal Detection and Estimation”, Springer,2/e,1998

2. Harry L. Van Trees,” Detection, Estimation and Modulation Theory”(Detection, Estimation and Modulation Theory, Part-I), John Wiley & Sons,2002

PCC (Old Code:EET-503)	ADVANCED SEMICONDUCTOR DEVICES	3L:2T:0P	5 credits

Energy bands & charge carriers in semiconductors, Excess carriers in semiconductors, Junctions, BJT, Metal Oxide Field effect transistors, Negative conductance microwave devices, Optoelectronic Devices.

References:

1. B.G. Streetman, "Solid State Devices", PHI
2. Donald Neamen, Dhrubes Biswas /"Semiconductor Physics And Devices"/Tata McGraw-Hill / 6th Ed.
3. A.S. Sedra & K.C. Smith. "Microelectronic circuits", Oxford University press.
4. Lectures of NPTEL.

PCC	Neural Network	3L:1T:0P	4 credits

Course outcome:

On completion of the course, student will be able to:

1. Understand the learning and generalisation issue in neural computation.
2. Understand the basic ideas behind most common learning algorithms for multilayer perceptrons, radial-basis function networks, and Kohonen self-organising maps.
3. Implement common learning algorithms using an existing package.
4. Apply neural networks to classification and recognition problems.
5. To formalize the problem, to solve it by using a neural network

Syllabus

Neural Networks: History, Articial and biological neural networks, Artificial intelligence and neural networks

Neurons and Neural Networks: Biological neurons, Models of single neurons, Different neural network models

Single Layer Perceptrons: Least mean square algorithm, Learning curves, Learning rates, Perceptron

Multilayer Perceptrons: The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm

Radial-Basis Function Networks: Interpolation, Regularisation, Learning strategies

Kohonen Self-Organising Maps: Self-organising map, The SOM algorithm, Learning vector quantisation

Recommended Books:

1. An Introduction to Neural Networks, K. Gurney, UCL Press, London, 1997
2. Introduction to Neural Networks, R. Beale and T. Jackson, IOP Press, 1990

3. The Essence of Neural Networks, R. Callan, Prentice Hall Europe, 1999
4. Neural Networks: A Comprehensive Foundation, Simon Haykin, Prentice Hall, 1999

II[nd] Semester

PCC(Old Code: EET 502)	**DIGITAL COMMUNICATION**	**3L:1T:0P**	**4 credits**

Course Outcome:

On completion of the course, student will be able to:

1. Analyse different pulse modulation schemes with the basics of sampling, quantization, encoding and time division multiplexing.
2. Understand the concepts of base band and pass band digital transmission and partial response signaling.
3. Analyse and compare different digital modulation schemes.
4. Understand the concepts of error control coding schemes
5. Understand spread spectrum technique with modulation.

Syllabus

PCM, DPCM, DM, TDM; ISI, Pulse shaping, Partial response signaling, Optimum transmit and receive filters, Error probability, Equalization, Matched filtering, Correlation Receivers, Digital Transmission- Baseband and Passband. Baseband Signaling- Unipolar, Bipolar, RZ, NRZ etc., Digital modulation, Keying- ASK PSK, FSK, MASK MPSK, MFSK; Error correcting codes Linear and Convolutional codes; Spread Spectrum Techniques- Direct Sequence Frequency Hopped, CDMA.

References:

1. John G. Proakis, Masoud Salehi, “Communication Systems Engineering”, Pearson Education.
2. Proakis J. G. / “Digital Communications” / McGraw Hill /
3. Haykin, Simon / “Communication Systems” / John Wiley
4. Lathi, B.P / “Modern Digital & Analog Communication Systems” / Oxford University Press /.
5. Simon Haykin / “Digital Communication” / John Wiley.
6. Taub& Schilling / “Principles of Communication Systems” / Tata McGraw-Hill /
7. Proakis J. G. / “Digital Communications” / McGraw Hill /
8. Schaum’s Outlines / “Analog & Digital Communication” / Tata McGraw-Hill.

PCC (Old Code: EET 504)	**OPTICAL COMMUNICATION**	**3L:1T:0P**	**4 credits**

Course Outcome:

On completion of the course, student will be able to:

1. Understand the Basic Principles of Wave Propagation through Optical Fiber, Characteristics of Optical Fibersand Signal Degradation in Optical Fibers, Optical Emission, Optical Source Materials.
2. Compare Structure and Operation of LED and Laser diodes
3. Understand and compare Principles of Optical Detection, Structure, Operation and characteristics of PIN, APD and its Noise Performance.
4. Understand the principle of operation and designing of Optical Receiver and analyze different types of Noise. Design and analyze Complete Optical Communication Link.
5. Analyze Recent developments of Existing and Future Application Areas of optical wireless communication.

Syllabus

Wave Propagation through Optical Fibers, Optical Sources, Optical Detectors, Optical Receiver Design, Optical Fiber Communication Systems; Digital system design, Modulation formats for analog optical communication systems, Introduction to WDM concepts, advanced multiplexing strategies.

Optical Wireless Communication: Introduction, Historical Overview, Recent developments Existing and Future Application Areas

References:

1. Keiser, Gerd / "Optical Fiber Communications" / McGraw-Hill.
2. Senior, John M. / "Optical Fiber Communications Principles & Practices" /Prentice-Hall (India).
3. William, B. Jones Jr. / "Introduction to Optical Fiber Communication Systems" / Holt, Rinehart and Winston, Inc. International Edition
4. Wilson, J. & Hawkes, J.F.B. / "Optoelectronics an Introduction" Prentice-Hall(India)
5. Khare, R.P. /"Fiber Optics & Optoelectronics" / Oxford University Press
6. Agrawal, D.C. / "Fiber Optic Communication" / S. Chand
7. Slavarajan, A., Kar.S. & Srinivasan T. / "Optical Fiber Communication Principles & Systems" / Tata McGraw Hill.
8. Roberto Ramirez-Iniguez, Sevia M. Idrus, Skudai Johor, / “Optical wireless communication: IR for Wireless Connectivity”/ZiranSun, CRC Press.
9. Uysal, M., Capsoni, C., Ghassemlooy, Z., Boucouvalas, A., Udvary, E. /Optical Wireless Communications: An Emerging Technology/.

Journal Papers: Will be specified at the time of the course according to the latest development in the field.

IIIrd Semester

PCC (Old Code: EET-601)	**ADVANCED DIGITAL SIGNAL PROCESSING**	**3L:1T:0P**	**4credits**

Course outcome

On completion of the course, student will be able to:

1. Analyze the signal in time as well as frequency domain simultaneously.
2. Represent the signal in terms of Haar scaling functions and Haar wavelet functions using Multi Resolutional Analysis.
3. Acquire the basics of multi rate digital signal processing.
4. Have an in-depth knowledge of use of digital systems in real time applications.
5. Understand about different Digital Signal Processors hardware and circuits.

Syllabus

Review of linear algebra; functional analysis, time-frequency representation; frequency scale and resolution; uncertainty principle, short-time Fourier transform, Multi- resolution concept and analysis, Wavelet transforms. Wigner-ville distributions. Multi- rate signal processing; discrete-time bases and filter banks; 2D signals and systems, 2D sampling in arbitrary lattices, 2D-linear transforms, 1 D/2D signal compression; introduction to DSP architecture.

References:

1. Candy J. V.," Signal Processing", MGH, New York
2. Proakis John G. and C.M. Rader, F. Ling and C.L. Nikis" "Advanced Digital Signal Processing", Maxwell Macmillan International Edition.
3. Lectures of NPTEL.

List of Electives for M. Tech Electronics & Communication

Elective-I (PEC-1)

Sl. No.	Old Course Code	Name of the course	Credit (L-T-P)
8.	EET-551	Space Communication	4(3-1-0)
9.	EET-553	Organic Electronics	4(3-1-0)
10.	EET-555	RF Systems	4(3-1-0)
11.	EET-557	Digital System Design	4(3-1-0)
12.	EET-559	Advanced Microprocessor	4(3-1-0)
13.	EET-561	Communication Theory	4(3-1-0)
14.		Analog VLSI Circuits	4(3-1-0)

Elective-II (PEC-2)

Sl. No.	Old Course Code	Name of the course	Credit (L-T-P)
7.	EET-	Antenna Analysis & Synthesis	4(3-1-0)

	552		
8.	EET-554	VLSI System Design	4(3-1-0)
9.	EET-556	Wireless Communication	4(3-1-0)
10.	EET-558	Information Theory & Coding	4(3-1-0)
11.	EET-560	Architecture & Applications of Digital Signal Processors	4(3-1-0)
12.	EET-562	Embedded Systems	4(3-1-0)

Open Elective (PEC-3)

Sl. No.	**Old Course Code**	**Name of the course**	**Credit (L-T-P)**
8.	EET-651	Telecommunication & Switching	4(3-1-0)
9.	EET-653	Image Processing	4(3-1-0)
10.	EET-655	Data Communication Networks	4(3-1-0)
11.	EET-657	Fuzzy Electronics	4(3-1-0)
12.	EET-659	Photonic Networks	4(3-1-0)
13.	EET-661	VLSI Implementation of Digital Processors	4(3-1-0)
14.	EET-663	Mobile Communications	4(3-1-0)

PEC-1

PEC-1 (Old course code: EET -551)	SPACE COMMUNICATION	3L:1T:0P	4 credits

Course outcome

On completion of the course, student will be able to:

1. Learn and understand the basic laws and dynamics of the satellite.
2. Understand communication satellite design.
3. Analyze and understand how analog and digital technologies are used for satellite communication networks.
4. Understand the design of satellite links.
5. Study the design of Earth station and tracking of the satellites.

Syllabus

Introduction, Historical background and overall perspective, Orbital considerations, Launching, Atmospheric effects, Transponders, satellite network modeling, link calculations, FM analysis, Multiple access: FDMA, TDMA, CDMA, Earth stations, TV Transmission, Introduction to GPS. Recent Developments

References:

1. Pratt & Bostian, "Satellite Communications", John Wiley & Sons
2. Roddy D. "Satellite Communications", Prentice Hal
3. M. Richaria, "Satellite Communication Systems"

PEC-1 (Old Course code: EET -553)	ORGANIC ELECTRONICS	3L:1T:0P	4 credits

Course outcome

1. Have the overview of organic semiconductor and basics of Molecular quantum Mechanics.
2. Analyze optical and electrical properties of semiconductor material for TFT.
3. Analyze the basic material for optical source and also deal with its designing aspects.
4. Apply these concepts on research opportunity in this area.

Syllabus

General Overview of Organic Semiconductors and Electronics Introduction to some of the basics of Molecular Quantum Mechanics; Optical and Electrical Properties of Organic

Semiconductor Material; Organic Thin Film Transistor (OTFT) -physics and processing; Organic Light Emitting Diode (OLED) -physics and processing; OLED passive: and active matrix displays, OTFT circuits; Organic Solar Cell -physics and processing; Research opportunities in organic electronics and the associated technologies.

References:

1. P. W. Atkins and R.S. Friedman, "Molecular Quantum Mechanics", Oxford.
2. Martin Pope and Charles E. Swenberg, "Electronics Processes in Organic Crystals and Polymers", Oxford Science Publications
3. W. Brutling (Editor), '"Physics of Organic Semiconductors", Wiley- YCH
4. Zakya H. Kafafi (Editor), "Organic Electroluminescence" CRC Press
5. Sam-Shajing Sun and Niyazi Serdar Sarciftci (Editors), "Organic Photovoltaics - Mechanisms, Materials and Devices", CRC Press

PEC-1 (Old Course Code: EET-555)	RF SYSTEMS	3L:1T:0P	4 credits

Course outcome

1. Understand the basic concept and behavior of microwave components and different types of transmission Lines-Equivalent Circuit representation.
2. Understand concept of resonator and filter configurations.
3. Know about working of RF diode and BJT.
4. Understand different matching techniques and Characteristics of amplifier.
5. Analyzing working principle of high frequency oscillators and basic characteristics of mixer.

Syllabus

Introduction: Importance of RF and Microwave Concepts and Applications- and Units Frequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.

Resonators: Basic resonator and filter configurations-special filter realization-filter implementation coupled filter.

RF diode and BJT:RF diodes-bipolar junction transistor - RF field effect transistor-high electron mobility transistors-diode models-transistor models-measurement of active devices-scattering parameter device characterization.

Impedance matching: Impedance matching using discrete components-micro-strip line matching networks amplifier classes of operation and biasing networks.

Characteristics of Amplifiers: Characteristics of amplifier-amplifier power relations-stability consideration-constant gain-broadband, high power, and multistage amplifiers.

High frequency oscillators: Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixer.

Reference Books

1. Reinhold Ludwig, Gene Bogdanov**,** *"RF circuit design, theory and applications",* Pearson Asia Education.
2. D. Pozar, *"Microwave Engineering"*, John Wiley & Sons, New York.
3. Bahil and P. Bhartia, *"Microwave Solid State Circuit Design",* Wiley-Interscience.

4. RF Microelectronics by Behzad Razavi

PEC-1	DIGITAL VLSI CIRCUITS	3L:1T:0P	4 credits

Course outcomes:

On completion of the course, student will be able to:

1. Learn the design rules of future trends in integrated circuit technology.
2. Understand qualitative understanding of MOS devices.
3. Determine and quantify interconnection.
4. Design combinational logic gates in CMOS.
5. Design sequential logic circuits (flip-flops, latches, oscillators, pulse generators, and Schmitt triggers)

Syllabus

Introduction, The Manufacturing Process, The Devices, The Wire, The CMOS Inverter, Designing Combinational Logic Gates in CMOS, Designing Sequential Logic Circuits, Coping with Interconnect, Timing Issues in Digital Circuits.

References:

1. Jan M Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective" Pearson Education.
2. John F. Wakerly, "Digital Design Principles and Practices", Prentice Hall.
3. Gaetano Boriello, Randy H. Katz, “Contemporary Logic Design”, Prentice Hall
4. Howard G. Johnson, "High-Speed Digital Design - A handbook of black magic", Prentice Hall
5. Wayne Wolf, “FPGA-based System Design”, Prentice Hall

PEC-1 (Old Course Code: EET -559)	ADVANCED MICROPROCESSORS	3L:1T:0P	4 credits

Course outcome

1. Have the basic knowledge of 16 bit microprocessor, Microcontroller and ARM processor with its memory organization and control.
2. Able to design smaller modules using Assembly language programming.
3. Apply these concepts on different addressing modes, interrupts.
4. Apply these concepts on real world application.

Syllabus

Architecture of 16 Bit Microprocessor (8086), Instruction Set, Memory Organization and Memory Control; Signals for 8086 Microprocessor, Input / Output Interface, Interrupt Structure, Assembly Language Programming, Controllers, Intel 80286, 80386, 80486, Pentium Processors, ARM Processors.

Microcontrollers: Introduction to 8031/8051, Microcontroller's Architecture, Memory Organization, Internal 8051 Memory, Addressing Modes, Interrupt Structure and Interrupt

Priorities, Port Structure and Applications, Accessing Internal and External Memory, Timer/Counter Function and Different Modes of Operations.

References:

I. Hall, D. V. "Microprocessor and Interfacing", TMH
2. Brey, "The Intel Microprocessor", PHI
4. Y. Rajasree, "Advanced Microprocessor", New age international publishers.
5. Aditya P. Mathur, "Introductionto Microprocessors", TMH.
6. Hennessy &Pattereson, "Computer Architecture" Elsevier.

PEC-1 (Old Course Code: EET -563)	**COMMUNICATION THEORY**	**3L:1T:0P**	**4 credits**

Course outcome

1. Have the basic knowledge of rate distortion theory and different digital modulation schemes.
2. Apply these concepts on digital transmission with its challenges.
3. Analyze different modulation schemes with its receivers.
4. Design a communication system with its various challenges in cellular mobile communication.

Syllabus

Rate distortion theory, channel coding theorems, digital modulation schemes, Trellis coded modulation, digital transmission over band limited channels, fading multipath channels, synchronization. Analog modulation schemes, optimum/suboptimum receivers, diversity combing, cellular mobile communication. Equalization.

References:

1. S.Haykin, "Communication Systems", Wiley Eastern
2. D.Sakrison, "Communication Theory", John Wiley & Sons
3. Taub & Schilling, "Principles of communication systems" McGraw Hill

PEC-1	**Analog VLSI Circuits**	**3L:1T:0P**	**4 credits**

Course Outcomes:

On completion of the course, student will be able to:

1. Apply knowledge of mathematics, science, and engineering to design and analysis of analog integrated circuits.

2. Identify, formulates, and solves engineering problems in the area of analog integrated circuits.

3. Understand various dissipation types in CMOS.

4. Estimate and analyse the power dissipation in VLSI circuits.

5. Derive the architecture of low power SRAM circuit.

Syllabus

Analog MOS circuits, opamps, frequency and transient responses, stability and compensation. Analog switches, sample and hold circuits, switched capacitor circuits. MOS inverters and gate circuits, interfacing, transmission gates. MOS memory circuits. Digital building blocks multiplexers, decoders, shift registers,etc. Gate array, standard cell, and PLA based designs. Digital to Analog and Analog to Digital converters.

Text Books:

1. Behzad Razavi,/ Design of Analog CMOS Integrated Circuits/Tata McGraw-Hill Education
2. Low Power CMOS VLSI Circuit Design- Kaushik Roy and Sarat C. Prasad

PEC-2

PEC-2 (Old Course Code: EET -562)	EMBEDDED SYSTEMS	3L:1T:0P	4 credits

Course outcome

1. Understand the basics of ARM Processors.
2. Study RTOS features along with DSP.
3. Learn C for embedded systems.
4. Understand case studies related to design of embedded systems.
   Understand the application of embedded systems.

Syllabus

Introduction to Embedded systems & RTOS, Embedded processors (86, Motorola- PPC, ARM), Application areas, Devices & Architecture of ARM, PPC, X86, Review of memory Architecture, I/O, Timer Counter & Interrupts.

Introduction to DSP, Interface to Analog world, RTOS, Scheduler Algorithm (Rate monotonic, Deadline monotonic), Priority, Priority Inversion, Task, Threads, Processes, Memory Management, and Commercially available- RTOS

C for embedded Systems: Programming considerations like memory usage, runtime library usage, interrupt service routines. Booting process, memory mapping address space, external registers system registers, cache management etc. Device drivers for embedded systems.

Interfacing C with assembly code- Inline assembly. Serial communications, networking stack protocols for embedded systems.
Design &Tools: Design of an embedded application, Examples / Case Study.

References:

1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages ", Second Edition. Harlow: Addison-Wesley-Longman.
2. Raymond J.A. Bhur and Donald L.Bialey, "An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey.
3. Grehan Moore, and Cyliax, "Real time Programming: A guide to 32 Bit Embedded Development. Reading" Addison- Wesley- Longman.
4. Heath, Steve, "Embedded Systems Design ", Newnes.
5. Embedded System Design: A Unified Hardware /Software Introduction, Frank Vahidand Tony Givargis, Wiley.

PEC-2 (Old Course Code: EET -552)	**ANTENNAS ANALYSIS & SYNTHESIS**	**3L:1T:0P**	**4 credits**

Course Outcome:

1. Understand the basic concept of radiation inside antenna and their different structure.
2. Understand the basic Parameters of antenna, with Analysis of dipole antenna and their application.
3. Apply the concepts for understanding different antenna arrays.
4. Analyze different types of antenna like Loop antenna, micro strip antenna, and helical antenna.
5. Understand the concept of smart antenna and measurement of antenna.

Syllabus

Vector potential antenna theorems and definitions, dipole, loop, slot radiators, aperture antennas array theorems, pattern synthesis, self and mutual impedance, scanning antennas, signal processing antennas, traveling wave antenna, antenna measurements.

References:

1. Robert S. Elliot, "Antenna theory & Design", PHI
2. J.D. Kross," Antenna Theory", McGraw Hill International
3. C.A. Ballani, / “Antenna Theory: Analysis and Design”/, Wiley
4. C.A. Ballani, / “Modern Antenna Handbook”/, Wiley.

PEC-2 (Old Course Code: EET -554)	**VLSI SYSTEM DESIGN**	**3L:1T:0P**	**4 credits**

Course outcome

1. Understand different implementation strategies for fabrication of digital ICs.

2. Understand parasitic parameters of digital components.
3. Apply these concepts to understand the Arithmetic building blocks, Memory, Array structures.
4. Analyze the timing issues for designing a digital ICs and architecture design using VHDL.
5. Apply the concept to validation of digital circuits.

Syllabus

Emphasis on the synthesis based approach to VLSI Design Relevant issues related to physical design automation such as placement, floor planning, routing and compaction are covered. Combinational & sequential logic synthesis issues and algorithms are discussed. Detailed coverage of HDLs and high level synthesis algorithms and issues.

References:

1. D.A. Pucknell, "Basic VLSI Design:"
2. Kamran Eshranghian, Neil Weste, "Principles of CMOS Design",
3. Addison Wesley & Rashid, "Spice for Circuit of Electronics using Pspice", PHI
4. Baker Li Zoyce, "CMOS Circuit Design, Layout and Simulation", PHI.

PEC-2 (Old Course Code: EET -556)	**WIRELESS COMMUNICATION**	**3L:1T:0P**	**4credits**

Course outcome

1. Understand the basics of wireless communication
2. Understand digital modulation techniques
3. Study coding of wireless channels
4. Study MIMO concepts

Syllabus

Introduction to Wireless Communications, multi path channel models, capacity of wireless channels, performance of digital modulation techniques over wireless channels, combining techniques, multicarrier modulation, coding for wireless channels, overview of current wireless standards, MIMO techniques

References/Text Books:

1. Wireless Communications: Principles and Practice by TS Rappaport, Prentice Hall
2. Principles of Mobile Communications by GL Stuber, Kluwer Academic
3. Wireless Communications by AJ Goldsmith, Cambridge University Press.
4. Multiuser Detection by S Verdu, Cambridge University Press,
5. Modern Wireless Communications by S Haykin and M Moher, Prentice Hall, 2004.

PEC-2 (Old Course Code: EET - 558)	**INFORMATION THEORY AND CODING**	**3L:1T:0P**	**4 credits**

Course outcome

1. Understand the concepts of entropy and mutual information with its application in the communication system.
2. Understand different source coding techniques with some practical applications.
3. Apply and analyze the concepts of channel properties such as channel capacity in communication.
4. Analyze and understand the different channel coding techniques with its application in various fields.
5. Analyze and apply these concepts to video abstraction, image compression and speech coding techniques, variational autoencoders.

Syllabus

Coding- Source Encoding & Channel Encoding, Entropy and mutual information, rate distortion function, Source Encoding -Source Encoding Theorem, Variable length coding, Discrete memory less channels, capacity cost functions, Channel coding theorems; Channel Capacity Theorem, Channel Encoding- Linear block codes, Cyclic codes, Convolutional codes, Sequential and Probabilistic decoding, Majority logic decoding, Burst error-correcting codes.

References:

1. Cover & Thomas, "Elements of Information Theory"
2. Peterson & Weldon, "Information and coding theory
3. Robert Ash, "Information Theory'
4. Gallager, "Information Theory and Reliable Communication"

PEC-2 (Old Course Code: EET -560)	**ARCHITECTURE AND APPLICATIONS OF DIGITAL SIGNAL PROCESSORS**	**3L:1T:0P**	**4 credits**

Course outcome

1. Understand about different Digital Signal Processors hardware and circuits.
2. Know the architecture and instruction set for various digital signal processors.
3. To apply these concepts on programming & downloader.
4. Apply the concepts in synchronization filtering voice /speech processer.
5. Apply these concepts in applications e.g. telecomm, Image, military & other apps.

Syllabus

DSP Processors: DSP Hardware & Circuits; 8-bit, 16-bit, 32-bit DSP Processors; Analog Devices, DSP Processors Devices and their Comparison. Data width and dynamic range, Limitations of DSPs.

Architecture: DSP System, ADSP-2100 Family base Architecture, MAC & Shifter block diagrams, architectures of real digital signal processors

Instruction Set: Instruction Sets, Certain application programs: ADC/DAC, Filter design, Function Generation etc.

Applications: Filtering: Low pass, high pass, band pass, Hilbert transformations etc.

Voice/Speech

Voice mail, speech Decoding, speech recognition Speaker Verification etc

Telecommunication: Digital PBX, Line Repeaters, MODEMS, Data Encryption etc.

Imaging: Image Transmission Compression, Pattern recognition Image Enhancement, Homomorphic Processing etc.
Instrumentation: Spectrum Analysis, Pattern matching, Transient Analysis etc.
Military: Radar & Sonar Processing, Image Processing Radio frequency MODEM, Missile Guidance.

References:

1. Sen M. Kuo & Woon-Seng S. Gan, "Digital Signal Processors-architectures, implementation and applications" / Pearson Education
2. K. Padmanabhan, S. Ananthi & R. V. Rajeshwaran / *"A* Practical Approach to Digital Signal Processing"
3. TMS, Data Manual
4. ADSP Data Manual
5. Robiner, L.R. & Gold, B. / "Theory and application of Digital Signal Processing" / Prentice-Hall (India).
6. Oppenheim, A. V. & Schafer R. W. / "Digital Signal Processing" / Prentice-Hall {India).

PEC-3

PEC-3 (Old Course Code: EET-651)	**TELECOMMUNICATION SYSTEM ENGINEERING**	**3L:1T:0 P**	**4 credits**

Course Outcome

1. Understand concept of Clos Network, Recursive construction of switches.
2. Learn about Clos theorem, Duguidtheorm. Paull's theorem, Paull's matrix and their application.
3. Understand Mathematical modeling, Blocking Models (Lee's approximation), Karnaugh's method for Blocking probability estimate.
4. Understand SS7 architecture and protocol stack. IP telephony, IP network architecture, Generic architecture.
5. Analyze various packet switching architectures with their advantages and disadvantages.

Syllabus

Clos Network, Recursive construction of switches, strictly Non-blocking, re-arrangebly non-blocking, Clos theorem, Duguid theorm. Paull's theorem, Paull's matrix, Cantor network.
Network traffic arrival and Service characterization, Erlang formulae, Mathematical modeling, Blocking Models (Lee's approximation), Karnaugh's method for Blocking probability estimate.
Stored program control (SPC) exchange, Space, Time switch implementation. Super multiplexing. Operating system architecture for switching system. Overload control mechanisms.
User to network signaling, pulse, tone signaling, common channel signaling. SS7 architecture and protocol stack. IP telephony, IP network architecture, Generic architecture, Banyan networks, Delta networks, Shuft1enet as delta network, buffered banyan network, Input vs. output queuing. Discussion of various packet switching architectures.

References:

1. Joseph Y. Hui. Switching and Traffic theory for integrated broadband networks, Kluwer Academic Press

2. M. Schwartz, Telecommunication Networks: protocols. Modeling and analysis, Addison- Wesley Longman publishing company.
3. H. Jonathan Chao, Broadband Packet Switching Techno1ogy- A practical guide'. to ATM Switches and 1P routers, John Wiley and sons. Inc.
4. T. Viswanathan, Telecommunication Switching Systems and networks, Prentice Hall of India.
5. R-L. Freeman, Telecommunication System Engineering, John Wiley and Sons

PEC-3 (Old Course Code: EET-653)	**IMAGE PROCESSING**	**3L:1T:0P**	**4 credits**

Course Outcome

1. Understand the digitization, segmentation shape representation of images.
2. Have the basic knowledge of data structure for image processing.
3. Apply these concepts on image transforms and image enhancement.
4. Also analyze image data compression on different image representation techniques.
5. Apply the concepts on 3D vision, geometry and radiometry.

Syllabus

Human visual system and image perception, monochrome & colour vision models, colour representation, image sampling & quantization, 2-D systems, image transform image coding, stochastic models for image representation, image enhancement restoration & reconstruction, image analysis using multi resolution techniques.

References:

1. Gonzales & Woods, "Digital, Image Processing", Addison Wesley
2. A.K Jain, Image Processing , Wiley Eastern.
3. W.K. Pratt, "Digital Image Processing"
4. A. Rosenfelf and A.C. Kak, "Digital Image Processing"
5. V. Bhaskaran & K. Konstantinides, "Image and Video Compression Standards".

PEC-3 (Old Course Code: EET-655)	**DATA COMMUNICATION NETWORKS**	**3L:1T: 0P**	**4 credits**

Course Outcome

1. Understand the concepts of OSI model, queuing theory, and physical layer.
2. Analyze and apply the concepts of error detection and correction techniques such as ARQ strategies.
3. Model and analyze the important media access control protocols
4. Understand the sharing of virtual circuits using ATM layer
5. Analyze the communication between virtual machines using virtual switches.

Syllabus

OSI model, queuing theory, physical layer, error detection and correction, data link layer, ARQ strategies, framing, media access layer, modeling and analysis of important media access control protocols, FDDI and DQDB MAC protocols for LANs and MANs, network layer, flow control & routing, TCP/IP protocols, ATM, Virtual Switches

References:

1. Kartalopoulos, "Understanding SONET/SDH and ATM Communication", Networks for the next millennium", PHI
2. A.S. Tanenbaum, "Computer Networks", PHI
3. William Stallings, "Data and Computer Communication", Pearson

PEC-3 (Old Course Code: EET-657)	**FUZZY ELECTRONICS**	**3L:1T:0P**	**4 credits**

Course Outcome

1. Understand uncertainty if information and different sets of fuzzy sets and their properties.
2. Understand and apply different DSW algorithm.
3. Apply these concepts on Fuzzification and defuzzification.
4. Analyze different models of fuzzy on digital components.
5. Apply fuzzy logic on real time applications.

Syllabus

Uncertainty in information; Classical Sets, Fuzzy Sets and their properties; Cardinality of Classical Relations and their properties, The a- Level Set, Cardinality of Fuzzy Relations and their properties; Composition; Tolerance and Equivalence relationship; Membership Functions; Fuzzification and De-Fuzzification process; Fuzzy to Crisp Conversions; Lambda cuts; Extension Principle, Crisp functions and its mapping, Fuzzy functions and its mapping; Fuzzy Numbers; Internal Analysis in Arithmetic; Approximate method of Extension, Vertex Method, DSW Algorithm, and Restricted DSW Algorithm and their comparison, Classical Predicate Logic; Fuzzy Logic; Approximate Reasoning; Fuzzy Tautologies, Contradictions, Equivalence, and Logical Proof; Fuzzy Rule Based Systems, Models of Fuzzy AND, OR, and Inverter; Fuzzy Algebra; Truth Tables; Fuzzy Functions; Concept of Fuzzy Logic Circuits; Fuzzy Flip- Flop; Fuzzy Logic Circuits in Current Mode

References:

1. Ahmad M. Ibrahim, "Introduction to Applied Fuzzy Electronics" Prentice Hall Publication
2. Ahmad M. Ibrahim, "Fuzzy logic for embedded systems applications" Newnes Publications
3. Abraham Kandel, Gideon Langholz "Fuzzy Hardware: Architectures and Applications" Springer Publications
4. Witold Pedrycz, Fernando Gomide "Fuzzy Systems Engineering: toward Human-centric Computing" John Wiley Publications
5. Witold Pedrycz "Fuzzy Control and Fuzzy Systems" Research Studies Press

PEC-3 (Old Course Code: EET-659)	**PHOTONIC NETWORKS**	**3L:1T:0P**	**4 credits**

Course Outcome

1. Understand basic mechanism of optical communication and its elements.
2. Apply the concepts on different multiplexing techniques and access networks
3. Understand and compare the conventional optical networks.
4. Get information about design issues of optical communication.
5. Analyze the routing and survivability of optical network.

Syllabus

Optical communications: Introduction to basic optical communications and devices. Optical multiplexing techniques Wavelength division multiplexing, Optical frequency division multiplexing, time division multiplexing, code division multiplexing. Optical Networks: Conventional optical networks, SONET / SDH, FDDI, IEEE 802.3, DQDB, FCS, HIPPI etc. Multiple access optical networks, Topologies, Single channel networks, Multichannel networks, FTFR, FTTR, TTFR and TTTR, Single hop networks, Multihop networks, Multi-access protocols for WDM networks, Switched optical networks. Optical amplification in all optical networks. All optical subscriber access networks. Design issues.

References:

1. Rajiv Ramaswami, Kumar Sivarajan, Galen Sasaki / Optical Networks: A Practical Perspective /Morgan Kaufmann Publishers
2. Giancarlo Prati, "Photonic Networks", Springer publication.
3. Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" / Pearson Education.
4. Singh, Jasprit / "Optoelectronics An Introduction to Materials and Devices"/ McGraw-Hill.
5. Khare, R.P. / "Fiber Optics & Optoelectronics" / Oxford University Press.
6. Gupta, S.C. / "Text Book of Optical Fiber Communication & Its Applications"/ Prentice–Hall (India).

PEC-3 (Old Course Code: EET-661)	**VLSI IMPLEMENTATION OF DIGITAL PROCESSORS**	**3L:1T:0P**	**3 credits**

Course Outcome

1. Represent the signal flow graph, data flow graph and dependence graph of DSP algorithms.
2. To apply the pipelining and parallel processing to speed up the DSP algorithms.

3. Apply the concept of retiming the DSP algorithms for trade off the speed and power.
4. Apply the concepts unfolding and folding the DSP algorithms.
5. Design the Systolic Architecture of the DSP algorithms.

Syllabus

Basics concepts of Digital Signal Processing, Iteration bound, Pipelining and parallel processing, Retiming, Unfolding and folding algorithms, Systolic Architecture Design Fast convolution, Algorithmic Strength Reduction in Filters and Transforms, Pipelined and parallel recursive and adaptive filters

References:

1. "VLSI Digital Signal Processing Systems-Design and Implementations" by Keshab K. Parhi; John Wiley & Sons, Inc.
2. "Digital Signal Processors-Architectures, Implementations and Applications" by Sen M. Kuo and Woon-seng S. Gan; Pearson Education, Inc.
3. "Digital Signal Processing and Applications with the C6713 and C6416 DSK" by Rulph Chassaing

PEC-3 (Old Course Code: EET-663)	**MOBILE COMMUNICATION**	**3L:1T:0P**	**4 credits**

Course Outcome

1. Understand the origin of mobile radio networks
2. Understand concept of multiple access schemes
3. Understand the concepts of cellular systems
4. Understand mobile-satellite communication

Syllabus

Introduction to mobile radio networks; channel description and analysis, propagation effects; TDMA, CDMA, SDMA, ODDMS, SC-OFDMA, IDMA and related multiple Access Techniques; Concepts and Design cellular systems, GSM systems, GPRS; mobile satellite communication, wireless third generation and fourth cellular communication system; WCDMA, CDMA 2000.

References:

1. K. David & T. Bgenker, "Digital Mobile Systems"
2. J. Dunlop et aI, "Digital Mobile Communication and The T'etra System"
3. Upena Dalal, “Wireless Communication” OXFORD University Press, Higher Education Series
4. I. S. Mishra, “Wireless Communication & Networks” TMH Publication
5. V.K. Garg, “Wireless Networks Evolution- 2G to 3G” Pearson Education
6. W. C. Y. Lee, “Wireless and Cellular Telecommunications” 3rd Ed., MGH, 2006.
7. G. L. Stuber, “Principles of Mobile Communications” 2nd Ed., Springer, 2007.

8. Simon Haykin and Michael Moher, “Modern Wireless Communication” Pearson education, 2005.

IVth Semester

Seminar

Course Outcome

After the completion of Seminar work students will be able to:

1. Have depth knowledge of one area of Electronics & Communication.
2. Complete an independent research project, resulting in at least a thesis publication, and research outputs in terms of publications in terms of journals, conference proceedings.
3. Grasp the knowledge of challenging issues in their chosen field of research.
4. Show his ability to present and defend his research work to a panel of experts.
5. Understand how to do critical analysis of any research article.

Dissertation

Course Outcome

After the completion of dissertation work students will be able to:

1. Ready to collect information, analyse it and propose a novel solution for the same.
2. Understand the purpose of Research i.e., to use the technology and research for betterment of the society and also publish his/her work.
3. Understand the interdisciplinary nature of research as a technical product can never be realized without collaboration of multiple disciplines.
4. Gain the skill to communicate the research work by oral presentations, by scientific articles and by M. Tech. Thesis.
5. Understand the basic ethics of research and issues like plagiarism.