CURRICULUM
FOR
MASTERS OF TECHNOLGY IN
"ELECTRONICS & COMMUNICATION ENGINEERING"

SRI SAI UNIVERSITY PALAMPUR
(H.P.) INDIA

JULY 2017

CONTENTS

Foreword

Sri Sai University Palampur Himachal Pradesh has been established with a purpose of empowering people. The Vision and Mission of the university are:-

- **Vision**

To provide quality education for developing all round personality of students through curricular, co-curricular and extracurricular activities to meet ever growing manpower requirements of industry and other sectors of economy as per national priorities.

- **Mission**

a. To establish institutions for imparting quality education.
b. To promote creative and innovative research and development.
c. To ensure quality education by periodic review of curricula through industry- institute interaction.
d. To make efforts for updating knowledge of faculty/ staff through quality improvement programmes (Training and retraining)
e. To promote employability through development of requisite competency skills.
f. To work for cause of weaker sections, physically challenged and women welfare through education and enlightenment.
g. To make life healthier, better and modern by inculcating in students Indian values/ heritage.
h. To bring about out a holistic development of society by educating individuals.

At present programmes in Civil Engineering, Mechanical Engineering, Electronics & Communication Engineering and Computer Science Engineering are being run here to develop manpower having global perspective, faith in our Indian values and culture and competencies desired for profession. In order to keep curriculum relevant and up to date, the University created a position of 'Director Curriculum Development' supported by Board of Studies of different discipline. The objective of this is to make teachers and students to become active partners in design of curriculum and instruction.

Director, Curriculum Development has involved Vice Chancellor, Executive Director and senior faculty members of SSU Palampur and Engineering & Technology Colleges at Pathankot and Amritsar in the revision of curriculum . This has created awareness and importance of systematic curriculum design seminar of various programmes and role expected from all the stake holders.

This curriculum has been designed by taking into account incorporating the existing programmes as being run at SSU Palampur and referring to courses of Punjab Technical University, Jalandhar; various IITs; VIT Vellore; Jamia Milia Islamabad New Delhi; PEC University of technology, Chandigarh and innovations undertaken by NITTTR Chandigarh in curriculum design. Hope this Curriculum will bring desired results.

Dr Naresh Nagpal
Executive Director
Sri Sai Group of Institutes
Corporate office, Chandigarh.

PREFACE

Curriculum is a plan comprising of learning experiences; to be given to students for developing competencies as desired by the 'world of work' in their professional life. Curriculum for SSU programmes has been designed with active involvement of the faculty and other stake holders. This process of designing the curriculum was a unique learning experience for all those involved in the process and understands the meaning and importance of scientific and systematic design of curriculum. A group of teachers provided feedback to the coordinator to up to date Curriculum. This group also scanned employment opportunities and job skills expected from an engineering graduate for inclusion in the curriculum, so as to make it relevant. This results in developing in the faculty a sense of ownership due to their involvement in the process.

The steps followed in the design of Curriculum of the degree programme were:

I. Discussions of Director, Curriculum Development with Chancellor, Vice Chancellor and Executive Director regarding their views on their Vision and Mission of the University vis a vis constraints of programme as well as expectations of Director, Curriculum Development.

II. Orientation programme for senior faculty of SSU to educate them about a rational approach to Curriculum design and to know about their experience of implementing the existing curriculum.

III. Interaction with the faculty from various Institutions to know their view point on their specific discipline, areas of employment, profile of an engineer and curriculum etc.

IV. Analyze the guidelines given by AICTE. ABET and NBA for programme accreditation so as to adhere to the norms and standards for Curriculum of Engineering Degree programmes.

V. Analysis of syllabus and test questions of engineering services examination to ensure that designed curriculum includes most of the broad areas and their levels of expectations from fresh graduates.

VI. SSU faculty prepared Horizontal and Vertical organization of subjects of curriculum and learnt about taking decision on various components of Curriculum and their articulation and importance in terms of time. They also understood the logical and chronological placement of subjects in the whole Curriculum.

VII. A workshop was organized at SSCET Pathankot for having understanding of the common features of the programmes; present syllabus being followed at SSU, difference between PTU Curriculum and SSU curriculum and innovation possible in implementation of curriculum.

VIII. Feedback was collected from coordinators of SSU programmes on the aspects given in VII so as to incorporate these in Curriculum document.

IX. Obtain opinion of experts from industry and academic on the proposed curriculum for degree programme in different discipline of Engineering.

X. The curriculum documents were subsequently validated and finalized in consultation with SSU Faculty.

Curriculum provides requisite experiences to students through formal, no formal and informal activities towards development of occupational, personal, social and continuing learning skills for making students employable. Focus of teachers and students is all the time to active the objective and outcome of the programme stated in the document. Students are made responsible for their learning and teachers become facilitators in this process.

During the design of the curriculum, the constraints of resources of the system in which this curriculum has to be implemented have been considered. It is hoped that with the support of enlightened administration and motivated faculty, innovative methodology will be adopted in teaching-learning process for providing desired learning experiences to the students as stated in curriculum documents.

1. SALIENT FEATURES OF THE PROGRAMME

1. Name of the programme	:	M. Tech in Electronics & Communication Engineering
2. Duration of the programme:	:	2years
3. Entry Qualification	:	B.Tech/BE in Electronics and Communication
4. Pattern of Programme	:	Semester system (4 Semesters)
5. Duration of the Semester	:	16 weeks
6. Total hours per week:	:	29 to 34 hours
7. Ecological and Environmental Awareness Camp and follow up	:	Second Semester (2-3) days
8. Entrepreneurship Development Camp and follow up	:	Fifth Semester (2-3)days
9. Student centred activity	:	*library study/ independent study for searching and organization Information for use.

S.C.A will include

- Library study
- Market survey
- Information search (industry/ in trust)
- Seminar
- Expert lectures
- Camp for ecology & Environmental awareness, entrepreneurship development and personality development.

2. JOB OPPORTUNITY FOR M. TECH IN ELECTRONICS AND COMMUNICATION ENGINEERING

- **SCOPE FOR EMPLOYMENT**

Industries involving wireless communication and signal processing, micro and nano electronics lasers and optics, electronics devices, telecommunications, nanotechnology, robotics information systems, power systems, computer software-hardware integration, control systems and other advanced technologies.

Placement in leading core communication companies like BSNL, MTNL, Reliance communication, Tata telecom, Vodafone, Bharti telecom, Airtel, Nokia, CISCO, IBM, Intel ,Agilent, Alcatel, AT&T, Ericsson, Honeywell, Bosch, National Instruments, Texas Instruments, HCL, and others. Employment in Government sector such as Railway, Defence, information and Broadcasting sector, space Research. A large number of employment opportunities in education sector are also possible.

3. OUTCOME OF THE PROGRAMME

The Post Graduates of the ECE program:

- Will have a solid foundation in Electronics and communication engineering.
- Will have the analytical and practical skills to solve engineering problems along with competencies to apply knowledge in Mathematics and Science.
- Will have professional and communication skills to function as leaders and members of multi-disciplinary teams in engineering and other industries.
- Will have the capacity and motivation to function as ethically responsible professionals.
- Will be equipped to undertake lifelong learning.
- Will be prepared to ensure leadership role in addressing some of the technical issues of society.

4. STUDY AND EVALUATION SCHEME (FIRST TO FOURTH SEMESTER)

FIRST SEMESTER

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	L	T	P	Credits
EC- 501	Information Theory & Coding	3	2	0	3	1	--	4
EC-502	Research Methodology	3	2	0	3	1	--	4
EC-503	Microelectronics Technology	3	2	0	3	1	--	4
EC-504	Advanced Mathematics for Engineers	3	2	0	3	1	--	4
EC-505	Advanced Digital Communication	3	2	0	3	1	--	4
EC-506	Laboratory I	0	0	4	--	--	2	2
	Total	**15**	**10**	**4**	**15**	**5**	**2**	**22**

SECOND SEMESTER

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	L	T	P	Credits
EC-507	Digital Signal Processing	3	2	0	3	1	--	4
EC-508	Wireless and Mobile Communication	3	2	0	3	1	--	4
EC-509	Data & Computer Communication Network	3	2	0	3	1	--	4
EC-510	Digital VLSI Design	3	2	0	3	1	--	4
	Elective I	3	2	0	3	1	--	4
EC-511	Laboratory II	0	0	4	--	--	2	2
	Total	**15**	**10**	**4**	**15**	**5**	**2**	**22**

Elective I

1. Optical Communication EC-514
   OR
   Digital Speech & Image Processing EC-515

2. VHDL EC-516
   OR
   Nano Electronics EC-517

THIRD SEMESTER

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	L	T	P	Credits
	Elective II	3	2	0	3	1	--	4
	Elective III	3	2	0	3	1	--	4
EC-512	Seminar/ Literature Survey	4	0	0	4	--	--	4
EC-513	Dissertation-I	0	0	12	--	--	6	6
	Total	**10**	**4**	**12**	**10**	**2**	**6**	**18**

Elective II

1. Wireless Sensor Networks EC-518
   OR
   Advanced Microprocessor & Embedded System EC-519

2. Mixed Signal Design EC-520

Elective III

1. Satellite Communication EC-521

2. Low Power VLSI Design EC-522
   OR
   MEMS and Sensor Design EC-523

FOURTH SEMESTER

Course Code	Course Title	L	T	P	Total Hours	Credits
EC-524	Dissertation-II	--	--	--	36	18

EC-501 Information Theory and Coding

Unit1: Basic Concepts of Information Theory: A measure of Uncertainty, Binary Sources, Measure of Information for two-dimensional discrete finite probability Scheme, Noise characteristics of channel, Basic relationship among different entropies, Measure of mutual information channel capacity, Capacity of channel with symmetric noise structure BSC and BEC.

Unit2: Elements of Encoding: Purpose of encoding separable binary codes, Shannon Fano encoding, Average length of encoding massage, Shannon's Binary encoding, Fundamental Theorem of discrete Noiseless coding, Huffman's Minimum Redundancy codes. Coding for Reliable Digital Transmission & Storage: Introduction, types of codes, Modulation and Demodulation, Maximum likelihood decoding, types of codes, Modulation and Demodulation, Maximum likelihood decoding, types of error, error control strategies.

Unit3: Linear Block Codes: Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code. Cyclic Codes: Description of Cyclic codes, Generator and parity check matrices of cyclic codes, encoding of cyclic codes syndrome computation & error detection decoding of cyclic codes, Error trapping decoding of cyclic codes.

Unit4: BCH Codes: Description of codes, Decoding of BCH codes, Convolution Codes: Encoding of convolution codes, structural properties of Convolution codes, distance properties of Conventional codes, Distance Properties of convolution codes, Maximum likelihood decoding of convolution codes. Automatic Repeat Request Strategies: Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

Books:

1. F.M Reza: Information Theory, Mc Graw Hill

2. ShuLin & J Costeib: Error Control Coding, PHI

3. Dass, Mullick & Chatterjee: Digital Communication, John Wiley, Ed. 1992

EC-502 RESEARCH METHODOLOGY

Unit1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process.

Unit2.Problem Identification & Formulation: Research Question–Investigation Question–Measurement Issues–Hypothesis–Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.

Unit3. Research Design: Concept and Importance in Research – Features of a good research design –Exploratory Research Design–concept, types and uses, Descriptive Research Designs –concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Unit4. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.

Unit5. Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.

Unit6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample Practical considerations in sampling and sample size.

Unit7. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Unit8. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Books:-

1. *Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition*

2. *Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.*

3*. Research Methodology – C.R.Kothari*

EC503 MICROELECTRONICS TECHNOLOGY

Unit1: Review of MOS technology:

Basic MOS transistors, enhancement and depletion model transistors, N-MOS and C-MOS processor, thermal aspects of processing, and production of masks.

Unit2: Electrical properties of MOS circuit:

Parameters of MOS transistors pass transistor, N-MOS inverter, pull-up to pull down ratio for an N-MOS inverter, C-MOS inverters, MOS transistor circuit model, latch up on C-MOS circuits.

Unit3: Design processes:

MOS layers, stick diagram, design rules, AWA OX C-MOS process description, double metal single poly silicon C-MOS process.

Unit4: Basic circuit concepts:

Sheets resistance, area capacitance delay unit, inverter delay, super buffers, propagation delays.

Unit5: Subsystem design & layout:

Architectural issues, switch logic, gate logic, examples of combinational logic, clocked Sequential circuits and other system consideration.

Unit6: Scaling of MOS circuits:

Scaling factor, limitations, scaling of wires and inter connections

Books:

1. Basic VLSI design systems & circuits - by DA. And Eshrachian K (phi), 1988.

2. VLSI design techniques for analog & digital circuit - by Geigar BR, Allen PE & Strader ME (Mc graw hill 1990).

EC504 ADVANCED MATHEMATICS FOR ENGINEERS

Unit1. Fourier Transform:

Definition of fourier transform, Fourier integral theorem, Fourier sine and cosine integral, Complex form of fourier integrals, Fourier transforms, Inverse fourier transform, Properties, Modulation theorem, Convolution theorem for fourier transforms, Parseval's identity, Fourier transforms of derivative of functions, Relation between fourier and laplace transform.

Unit2. Z –Transform:

Definition of z-transform, Some standard z-transform, Properties of z-transforms, Modulation theorem, Convolution theorem for z-transforms, Evaluation of inverse z-transforms.

Unit3. Matrices and Linear System of Equations:

Solution of linear simultaneous equations by gaussian elimination, Crout's method, Iterative methods: Jacobins method, Gauss- seidal method, Determination of eigen values by iteration.

Unit4. Conformal Mapping:

Mapping, Conformal mapping, Bi-linear transformations, Cross ratio, Fixed point of Bilinear transformation, Some special transformation.

Unit5. Calculus of Variations:

Euler-lagrange's differential equation and application, The Brachistochrone problems, Isoperi-metric problem, Hamilton's principle and lagrange's equation.

Books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers
2. Fourier Series and Boundary Values Problems, Churchill, McGraw Hill.
3. Complex Variables & Applications, Churchill,McGraw Hill.
4. Calculus of Variations, Elsgole, Addison Wesley.
5. Higher Engineering Mathematics, N. P. Bali, Laxmi Publication.
6. Calculus of Variations - by Galfand & Fomin; Prentice Hall.
7. The Use of Integral Transforms - by I.N. Sneddon., Tata McGraw Hill.

EC505 ADVANCED DIGITAL COMMUNICATION

Unit1: REPRESENTATION OF BANDPASS SIGNAL AND SYSTEM:

Response of a band pass system to band pass signal, Representation of a band pass stationary stochastic processes, Representation of digitally modulated signals.

Unit2: MODULATION AND DEMODULATION FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL:

Representation of signal waveforms and channel characteristics optimum demodulation for completely known signal in additive Gaussian Noise, Binary signaling in an AWGN Channel. Mary orthogonal Signaling in an AWGN Channel, Multiphase Signaling waveforms, combined multiple phase and multiple amplitude waveforms, Carrier recovery for coherent demodulation.

Unit3: DETECTION:

Optimum demodulation for signals with random phase in additive Gaussian Noise, Non-coherent Detection of binary signal in an AWGN channel, Non Coherent detection of M-ary orthogonal signal in an AWGN channel.

Unit4:DIGITAL SIGNALLING OVER A CHANNEL WITH INTERSYMBOL, INTERFERENCE AND ADDITIVE GAUSSIAN NOISE:

Signal design for band limited channels, optimum demodulation for ISI and additive white Gaussian noise linear equalization Feedback equalization.

Books:

1. Simon Haykin: Communication System, Wiley Eastern Ltd. Ed. 1998

2. J.Dassm SK Mullick & PK Chatterjee: Principle of Digital Communication, Wiley Eastern Ltd.

3. Martin S.Roden: Digital and Data Communications System P.H.I London, Ed, 1998.

4. Viterbi, A.I and J.K Qmura: Principles of Digital Communication, McGraw Hill Company, New York.

EC506 LABORATORY I

At least ten experiments are to be performed related to the subjects taught in 1st semester using MATLAB.

EC507 DIGITAL SIGNAL PROCESSING

Unit1: DISCRETE – TIME DESCRIPTION OF SIGNALS & SYSTEMS:

Discrete-time sequences, response sequence, time invariant systems, stability and causality criterion for discrete-time system, linear constant coefficient difference equation, properties of real valued sequences, convolution, correlation.

Unit2: THE Z-TRANSFORM:

Sampling, Definition of Z-transform, Properties of Z-transform, The complex Zplane, Region of convergence in the Z-plane, Evaluation of Z-transform, Relation between FT & Z-Transform, The Z-transform of Symmetric sequences, The Inverse Z-transform. The systems function of a digital filter.

Unit3: THE DISCRETE FOURIER TRANSFORM (DFT):

Definition, its properties, DFT, IDFT pair, circular convolution, Computations for evaluating the DFT, FFT algorithm, Analytic derivation of the "decimation-in – time FFT algorithm", Some general observation on the FFT.

Unit4: INFINITE IMPULSE RESPONSE (IIR) FILTER DESIGN TECHNIQUES:

Introduction, Analog filter system function & frequency response, Analog low pass filter design techniques for Butterworth, Chebyshev Type-I and Type-II filters, Impulse invariance and Bilinear Transformation methods to convert Analog filters into Digital Filters. Transformation for converting low pass filters into other types. **FINITE IMPULSE RESPONSE (FIR) FILTER DESIGN TECHNIQUES:** Introduction, Designing, FIR filters by DFT method and frequency sampling method. Study of windows (Rectangular, Triangular, Hamming and Kaiser). Designing FIR filters with the windowing methods. **DIGITAL FILTER STRUCTURE:** The direct form I & II structures, Cascade & Parallel combination of IInd order sections.

Books:

1. J.G Proakis and D.G Manolakis: Digital Signal Processing, 1995 (PHI) III, Editon.

2. A.Oppenheim, R. Schafer, and J.Buck: Discrete Time Signal Processing, 1996 (PHI) VI, Editon.

3. L.Rabiner and B.Gold, Theory and Application of Digital Signal Processing, 1975, Prentice Hall of India.

EC508 WIRELESS AND MOBILE COMMUNICATION

Unit1: MOBILE RADIO SYSTMES: Introduction to mobile radio system, Paging systems, cordless telephone system, Cellular telephone systems-Cellular concept, frequency reuse, channel assignment strategies, interference and system capacity, trucking and grade of service, cell splitting, sectoring, microcell zone concept, HO Strategies.

Unit2: MOBILE RADIO PROPAGATION: Mechanism, free space path loss, long distance path loss models, Okumara model, Hata model, PCS model, Wideband PCS microcell model, indoor propagation models, Jake's channel model, Multipath characteristics of radio waves, signal fading, time dispersion,. Doppeler spread, coherence time LCR, fading statistics, diversity techniques.

Unit3:SPREAD SPECTRUM COMMUNICATION: Introduction to spread spectrum communication, multiple access techniques used in mobile wireless communication: FDMA/TDMA/CDMA, Cellular CDMA, packet radio protocols, CDMA, reservation protocols, capacity of cellular CDMA, soft HO.

Unit4: WIRELESS SYSTEMS: Wireless systems and standards – GSM standards, signalling and call control, mobility management, location tracing, wireless data networking, packet error mode line on fading channels, Performance analysis of link and transport layer protocols over wireless protocols over wireless channels, mobile data networking (Mobile IP), wireless data services, IS-95, GPRS.

Books:

1. W.C.Jakes: Microwave Mobile Communication, IEEE Press.

2. T.S Rappaport: Wireless Communications, Principles and Practices, Prentice Hall 1996.

3. William C.Y.Lee: Mobile Cellular Telecommunications, Analog and digital systems, McGraw-Hill-1995.

4. Kaveh Pahlavan & Allen H. Levesque: Wireless Information Networks, Wiley series in Telecommunication and signal processing.

5. Karnilo Feher: Wireless Digital Communications, Modulation and Spread Spectrum Applications. PHI, 2001.

EC509 DATA AND COMPUTER COMMUNICATION NETWORKS

Unit1: Introduction:

A Communication model, Data Communications, Data Communication Networking, Need for Protocol Architecture, A Simple Protocol Architecture, OSI Model, the TCP/IP Protocol Architecture.

Unit2: Data Communications:

Concepts, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity, Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of Sight Transmission. Signal Encoding Techniques: Digital Data, Digital Signals; Digital Data, Analog Signals, Analog Data, Digital Signals; Analog Data, Analog Signals.

Unit3: Digital Data Communication Techniques:

Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error correction, Line Configurations, Interfacing. Data Link Control:Flow control, Error Control, High-Level Data Control. Multiplexing: Multiplexing using Frequency Division, Synchronous Time Division and Statistical Time Division; Asymmetric Digital Subscriber Line Xdsl. Spread Spectrum: The Concept of Spread Spectrum, Frequency-Hoping and Direct Sequence Spread Spectrum, Code-Division Multiple Access.

Unit4: WAN and LAN:

WAN: Circuit Switching and Packet Switching: Switching Networks, Circuit Switching Networks, Circuit-Switching Concepts, Control Signaling, Softswitch Architecture, Packet –Switching Principles, X-25, Frame Realy. Asynchronous Transfer Mode: Protocol Architecture, ATM Logical Connections, ATM Cell, Transmission of ATM Cells, ATM Service Categories, ATM Adaptation Layer. LAN: Background Topologies and Transmission Media, LAN Protocol Architecture, Bridges, Layer 2 and Layer 3 Switches.

Books:

1. W Stallings, Data and Computer Communications, Prentice Hall of India, 1997, Pearson Edu.

2. R.G Gallager and D Bertsekas, Data Networks, Prentice Hall of India, 1992.

3. Data Communication by FOROUZAN TMCG & NETWORKING.

EC510 DIGITAL VLSI DESIGN

Unit1: Introduction:

Basic principle of MOSFETs, Introduction to large signal MOS models (long channel) for digital design.

Unit2: MOS Inverters Static and Dynamic characteristics:

Inverter principle, Depletion and enhancement load inverters, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, and Dynamic behavior, transition time, Propagation Delay, Power Consumption.

Unit3: MOS Circuit Layout & Simulation:

Layout design rules, MOS device layout: Transistor layout, Inverter layout, CMOS digital circuits layout & simulation, Circuit Compaction; Circuit extraction and post-layout simulation.

Unit4: Combinational MOS Logic Design Static MOS design:

Complementary MOS, Ratioed logic, Pass Transistor logic, Complex logic circuits, DSL, DCVSL, Transmission gate logic.

Unit5: Dynamic MOS design:

Dynamic logic families and performances.

Unit6: Memory Design:

ROM & RAM cells design

Unit7: Sequential MOS Logic Design:

Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Monostable sequential Circuits, Astable Circuits. Adders, Multilpier Circuits.

Unit8: VLSI Interconnects:

Interconnect delays, Cross Talks. Introduction to low power design, Input and Output Interface circuits.

Unit9: BiCMOS Logic Circuits:

Introduction, Basic BiCMOS Circuit behavior, Switching Delay in BiCMOS Logic circuits.

Books:

1. Kang & Leblebigi "CMOS Digital IC Circuit Analysis & Design"- McGraw Hill, 2003

2. JM Rabey, "Digital Integrated Circuits Design", Pearson Education, Second Edition, 2003

3. NHE Weste & K. Eshraghian, Principles of CMOS VLSI Design:A Sys.Pers., McGraw Hill Pub.

4. B.G. Streetman & S. Banerjee, Solid State Electronics.

5. Uyemera, CMOS Logic Circuit Design, Springer India Pvt. Ltd. New Delhi, 2007.

EC511 LABORATORY II

At least ten experiments are to be performed related to the subjects taught in 2nd semester.

EC514 OPTICAL COMMUNICATION

Unit1: Introduction:

Advantage of optical fiber communication, Elements of fiber communication link, Ray theory and electromagnetic mode theory for optical propagation, step index and graded index fiber numerical aperture. Optical Filters: Attenuation, Absorption, Linear and non-linear scattering losses, Dispersion, overall fiber dispersion, polarization, fiber bending losses, multimode step index and graded index fibers, single mode fiber, plastic clad and all plastic fibers, optical fibers cables, Doped fiber amplifier Dispersion shifted and dispersion flattered fibers, practical fiber profiles.

Unit2: Optical Sources:

Basic concepts; LED for optical communication, Burrus type double hetro structure, Surface emitting LED's, Shape geometry, Edge emitting LED's, LED to fiber launch system semiconductor lasers theory, modulation and characteristics, Fabry-Perot lasers quantum well and distributed feedback lasers. Photo Detectors: P-I-N Photo diodes: Theory and their characteristics, Avalanche Photo detectors, theory and their bandwidth Noise in APD.

Unit3: Optical Fiber Communication Systems:

Optical transmitter circuit; LED and laser drive of optical receiver circuit, structure, preamplifier, AGC equalization, optical power budge loading, Analog systems; analog modulation, Direct modulation, Sub carrier mode Distribution system, optical TDM sub carrier multiplexing, WDM.

Unit4: Coherent Systems:

Coherent receivers, homodyne and heterodyne detection, noise in receiver, polarization control, Homodyne receiver, reusability and laser synchronous demodulation, phase diversity receiver.

Books:

1. John Grover: Optical Communication Systems, PHI

2. Gerd Keiser: Optical Fiber Communication, 2nd Ed. Tata Mc Graw-Hill

3. Franz Jh &Jain VK, Optical Communication, Narosa Pub.

EC515 DIGITAL SPEECH AND IMAGE PROCESSING

Unit1: Introduction:

Review of Filter design. Linear phase FIR filters. Methods of FIR filter design. Methods of IIR filter design. Applications of FIR & IIR filter in speech, image, seismic, medical and other areas.

Unit2: Speech Processing:

Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing-the phasor mode, Fourier transfer, DFT, FFT. The hardware use of FIR & IIR filters. Software, Elements of speech Synthesis-speech Recognition-speech in the computer-human interface.

Unit3: Image Processing:

Characterization of images as two-dimensional discrete fields, unitary transforms— DFT. Hadamard, slant and cosine transforms, compression schemes-Karhunen Loeve compression predictive coding schemes. Image enhancement-gray scale modification, edge enhancement, restoration-Wiener filtering, constrained deconvolution, recursive filtering. Segmentation, edge detection, thresholding, textural properties, geometry and shape description.

Books:

1. Digital Signal Processing - by Proakis & Manolakis

2. Speech and Audio Processing for multimedia PC's - by Iain Murray

3. Digital Image Processing - by Keenneth R Castleman, Pearson Education Society.

4. Digital Image Processing - by Rafact Gonzalez and Richard E. Woods, Pearson Education Society.

EC516 VHDL

Unit1.Introduction to Hierarchical and Structured Design: Role of CAD Tools in the VLSI design process, CAD Algorithms for switch level and circuits simulation, Techniques and algorithms for symbolic layout, Algorithms for physical design – Placement and routing Algorithms, Compaction, Circuit extraction and Testing.

Unit2.Specification of Combinational Systems Using VHDL: Introduction to VHDL, Basic language element of VHDL, Behavioral Modeling, Data flow modeling, Structural modeling, Subprograms and overloading, VHDL description of gates.

Unit3. Description and Design of Sequential Circuits: Standard combinational modules, Design of a Serial adder with accumulator, State graph for control network, Design of a binary multiplier, Multiplication of a signed binary number, Design of a binary divider.

Unit4. Register-Transfer Level Systems: Execution graph, Organization of system, Implementation of RTL Systems, Design of RTL systems, Analysis of RTL systems.

Unit5. Data Subsystems: Storage modules, Functional modules, Data paths, Control subsystems, Micro programmed controller, Structure of a micro programmed controller, Micro instruction format, Micro instruction sequencing, Micro instruction Timing, Basic component of a micro system, Memory subsystem.

Unit6. I/O Subsystem: Processors, Operation of the computer and cycle time. Binary decoder, Binary encoder, Multiplexers and demultiplexers, Floating Point arithmetic-representation of floating point number, Floating point multiplication, Adders, Multipliers.

Unit7. PLA based synthesis: Multilevel logic synthesis, Logic optimization, Logic simulation, Compiled and event simulators, Relative advantages and disadvantages, Layout Algorithms, Circuit partitioning, Placement and routing algorithms, Automatic test program generation, Combinational testing, DAlgorithm and PODEM algorithm, Scan-based testing of sequential circuits, Testability measures for circuits.

Books:

1. J. Bhaskar, “A VHDL Primer”, Addison Wesley, 1999.

2. M. Ercegovac, T. Lang and L.J. Moreno, “Introduction to Digital Systems”, Wiley, 2000

3. C. H. Roth, “Digital System Design using VHDL”, PWS Publishing

4. G. DeMicheli, “Synthesis and optimization of digital circuits”, McGraw Hill.

EC517 NANOELECTRONICS

Unit1. Introduction of Nano-electronics: The "Top-Down" Approach; The "Bottom-Up" Approach; Why Nano-electronics; Nanotechnology Potential; MOS Scaling theory-Issues in scaling MOS transistors; Short channel effects; Requirements for non-classical MOS transistor; Metal gate transistor-Motivation, requirements, Integration Issues; High-k gate based MOSFET, Motivation, requirements, integration issues of high-k.

Unit2. Quantum Mechanics of Electrons: General postulates of quantum mechanics; Time-independent Schrodinger's equation-boundary conditions on the Wave function; Analogies between quantum mechanics and classical electromagnetic; probabilistic current density; Multiple particle systems; Spin and angular Momentum.

Unit3. Free and Confined Electrons Free Electrons: Free electron gas theory of metals; Electrons confined to a bounded region of space and quantum numbers; Partially confined electrons- finite potential wells; Quantum wells; Quantum wires; Quantum dots.

Unit4. Tunnel Junctions and Applications of Tunneling: Tunneling through a potential barrier; Potential energy profiles for material interfaces; Applications of tunneling; Coulomb blockade, Single-Electron Transistor (SET).

Unit5. Germanium Nano MOSFETs: Strain, Quantization; Advantages of germanium over silicon; PMOS versus NMOS; Compound semiconductors - material properties; MESFETs; Compound semiconductors MOSFETs in the context of channel quantization and strain; Hetero structure MOSFETs exploiting novel materials, strain, quantization.

Unit6. Non-Conventional MOSFET Structures: SOI-PDSOI and FDSOI; Ultrathin body SOI-double gate transistors, integration issues; Vertical transistors – FinFET and Surround gate FET; Carbon Nano-tube Transistors (CNT); Semiconductor Nano-wire FETs and SETs; Molecular SETs and Molecular Electronics.

Books:

1. Fundamentals of Modern VLSI Devices, Y. Taur and T Ning, Cambridge University Press.

2. Fundamental of Nanoelectronics, George W. Hanson Pearson Education.

3. Silicon VLSI Technology, Plummer, Deal, Griffin, Pearson Education India.

4. Encyclopedia of Materials Characterization, Edited by Brundle, C.Richard; Evans, Charles A. Jr.; Wilson, Shaun ; Elsevier.

EC518 WIRELESS SENSOR NETWORKS

Unit1: Introduction:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks
Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.

Unit2: Deployment and Configuration:

Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Routing protocols: Issues in designing routing protocols, Classification of routing protocols,Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

Unit3 Data Storage and Manipulation:

Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.

Books:

1. Holger Kerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)

2. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, “Wireless Sensor Network”, Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).

3. Feng Zhao, Leonidas Guibas, “ Wireless Sensor Network”,Elsevier, 1st Ed. 2004 (ISBN: 13- 978-1-55860-914-3)

4. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, “Wireless Sensor Network: Technology, Protocols and Application”, John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).

EC519 ADVANCED MICROPROCESSOR & EMBEDDED SYSTEM

Unit1: Microprocessor Architectural Concepts:

Review of 16-bit Microprocessor Architecture, Word Lengths, Addressable Memory, Microprocessor Speed, Architecture Characteristics, Registers, Instructions, Memory Addressing Architecture, ALU, GPR's, Control Logic And Internal Data Bus, Introduction to Pentium Architecture.

Unit2: Microprocessor Instructions and Communications:

Instruction Set, Mnemonics, Basic Instruction Types, Addressing Modes, Interfacing I/O Microprocessor, Polling And Interrupts, Interrupts And DMA.

Unit3: Microprocessor I/O:

Data Communication, Parallel I/O Serial Communication, Serial Interface and UART, Modem, I/O Devices, D/A & A/D Interface, Interface, Special I/O Devices.

Unit4: Embedded Controllers & Systems:

Architecture of 80186 & 80188 CPU subsystems, Addressing Modes, Instruction set, Basic IO subsystems, Memory Subsystem, Example embedded controllers.

Books:

1. Intel Series Of Microprocessors: By Berry B. Bray, TMH.
2. 8086 microprocessor & Architecture by Liu, Gibson; PHI.
3. Embedded Microprocessor System Design by Kenneth L. Short, Pearson Education.
4. Embedded Controllers by Berry B. Bray Pearson Education.

EC520 MIXED SIGNAL DESIGN

Unit1: Switched Capacitor Circuits: Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

Unit2: Phased Lock Loop (PLL): Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs-PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications

Unit3: Data Converter Fundamentals: DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

Unit4: Nyquist Rate A/D Converters: Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

Unit5: Oversampling Converters: Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibit quantizers, Delta sigma D/A

Books:

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition, 2002

2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

3. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2013

4. CMOS Integrated Analog-to- Digital and Digital-to-Analog converters-Rudy Van De Plassche, Kluwer Academic Publishers, 2003

5. Understanding Delta-Sigma Data converters-Richard Schreier, Wiley Interscience, 2005.

6. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Interscience, 2009.

EC521 SATELLITE COMMUNICATION

Unit1: Introduction:

Satellite communication, Brief History, Orbits of satellite: Low, medium and geo-synchronous main characteristics, Angle period, Returning period, Angle of Evaluation, Propagation Delay, Orbital spacing.

Unit2: Satellite Links:

Delay transponder, Earth Stations, Antennas and Earth Coverage, Altitude and eclipses.

Unit3: Earth Space Propagation Effects:

Frequency window, Free space loss, Atmospheric absorption, Rainfall Attenuation, Inospheric scintillation, Telemetry, Tracking and command of satellite. Detection: QPSK offset QPSK and MSK, Coherent and non-coherent detection, Error rate performance.

Unit4: Synchronization:

Principle and techniques, Multiple Access Techniques, FDMA, SPADE system, TDMA system, Concept and configuration, system timing frames format, SSMA Basu Principles, VSAT, Random Access, Space Communication, link design description of operational in TELSAT and INSAT system.

Books:

1. J.Martin: Communication Satellite System, PH Englewood

2. D.C Aggarwal: Satellite Communication, Khanna Pub.

3. Tri Ha Digital Satellite Communication Tata Mc Graw-Hill. 4. Harry and Vam Tress: Satellite Communication, IEEE Proceeding 1979.

EC522 LOW POWER VLSI DESIGN

Unit1. Introduction:

Need for low power VLSI chips, Sources of power dissipation in Digital Integrated circuits. Emerging low power approaches. Physics of power dissipation in CMOS devices.

Unit2. Device & Technology: Impact on Low Power Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

Unit3. Power Estimation Simulation Power analysis: SPICE circuit simulators, Gate level logic simulation, Capacitive power estimation, Static state power, Gate level capacitance estimation, Architecture level analysis, Data correlation analysis in DSP systems. Monte Carlo simulation. Probabilistic power analysis- Random logic signals, Probability & frequency, Probabilistic power analysis techniques.

Unit4.Low Power Design Circuit level: Power consumption in circuits, Flip Flops & Latches design, High capacitance nodes, Low power digital cells library Logic level- Gate reorganization, Signal gating, Logic encoding, State machine encoding, Precomputation logic

Unit5. Low Power Architecture & Systems: Power & performance management, Switching activity reduction, Parallel architecture with voltage reduction, Flow graph transformation, Low power arithmetic components, Low power memory design.

Unit6. Low Power Clock Distribution: Power dissipation in clock distribution, single driver vs distributed buffers, zero skew vs tolerable skew, chip & package co design of clock network

Unit7. Algorithm & Architectural Level Methodologies: Introduction, design flow, algorithmic level analysis & optimization, architectural level estimation & synthesis.

Books:

1. Gary K. Yeap, Practical Low Power Digital VLSI Design, KAP, 2002
2. Rabaey and Pedram, Low power design methodologies, Kluwer Academic,1997
3. Kaushik Roy, Sharat Prasad, Low-Power CMOS VLSI Circuit Design, Wiley, 2000

EC523 MEMS AND SENSOR DESIGN

Unit1. Introduction to MEMS:

MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors/Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.

Unit2. Mechanics of Beam and Diaphragm Structures:

Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.

Unit3. Air Damping Drag Effect of a Fluid:

Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.

Unit4. Electrostatic Actuation:

Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.

Unit5. Thermal Effects:

Temperature coeficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors.

Unit6. Applications of MEMS in RF MEMS:

Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Microresonator Modeling, Micromechanical Resonator Limitations.

Books:

1. S.M. Sze, “Semiconductor Sensors”, John Wiley & Sons Inc., Wiley Interscience Pub.

2. M.J. Usher, “Sensors and Transducers”, McMillian Hampshire.

3. RS Muller, Howe, Senturia and Smith, “Microsensors”, IEEE Press.

5. SUGGESTIONS FOR EFFECTIVE IMPLEMENTATION OF CURRICULUM

Curriculum for post graduate programmes in engineering and technology have been designed by SSU Palampur faculty with close cooperation of SSE Badhani and Amritsar They have understood the systematic approach of curriculum development and implementation. While designing the curriculum they have taken in to account employment scenario, equivalence with PTU curriculum and experience of implementing existing curriculum.

Some of the suggestions for effective implementation of curriculum are:

1.Vision and mission of institute, Philosophy objective and outcome of curriculum of programmes should be understood by all teachers and students. These should be displayed in the Department so that expectation of all stake holders are clear to everyone.

2.Principal with Head of Departments should analyze the curriculum to find out the requirement of resources for its implementation and prepare an action plan for their availability in time. Institute should network with other organizations for sharing resources and adopt innovative approaches for managing whole courses.

3.HOD's and teachers are managers of whole programmes and subject teaching respectively. Their success in achieving objectives depends on preparing academic plan and its judicious execution.

4.Teachers should prepare rationale and objective of their respective subjects, structure of content, method and media and table of specification for evaluation. This should be given to student so that they are aware of the outcome of the course.

5.Set up a group of teachers and final year students for sharing experiences of curriculum implementation and suggest further improvement.

6.Teachers are required to plan as follows for carrying out teaching learning process effectively: -

(a) Prepare profile of students for knowing their background and strengths so as to facilitate them in fulfilling their dreams of jobs and life.

(b) Analyze programme and develop teaching plan.

(c) Plan for guided self study exercises for student and available learning resources like journals, web site, educational video programming etc in addition to visit to industries and organizing industrial training, arranging expert lecture by alumni and experts from industry/ field.

(d) The co-curricular activities like organizing different camp, social gathering study tour, hobby club etc may be used to develop generic skills like communication skills, task

Management, problems solving, managing self, stress Management, Time Management and collaborating with others etc.

1. A project bank may be developed by the concerned department of the university in consultation with industry, research and other relevant field organizations.

2. Student may be given practical assignment and project to develop practical skills. This will help them in developing creativity and confidence for their gainful employment, (wage and self).

3. (a). Teachers and students should be aware of objectives and outcomes of whole programme and the role played by each subjects in achieving them as part of the curriculum.

   (b). Identification of project and their details should be prepared by all teachers in consultation with students at the beginning of the year. The projects should relate to state of art technology and require use of theoretical and advance planning practical knowledge.

   ©. Self learning and learning beyond syllabus should be encouraged by including optional subjects with scope of learning.

   (d). Department should develop a feedback Mechanism for teaching performance and a reward system for doing excellence work.

   (e) Academic calendar should include remedial classes and additional make up test to help academically weaker students. Students involved in mentoring junior students should be should be rewarded, who are actively doing mentoring.