PANJAB UNIVERSITY, CHANDIGARH-160014 (INDIA)
(Estd. under the Panjab University Act VII of 1947-enacted by the Govt. of India)

FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABI

AND THE

REGULATIONS

FOR

Regular & Modular
M.E. (Electronics & Communication Engineering)
2019-20

SCHEME OF EXAMINATION FOR
MASTER OF ENGINEERING (ELECTRONICS & COMMUNICATION)
Scheme of Examination 2019-20

Year: First **Semester: First**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	ECE 1101	Advanced Digital Signal Processing	3-0-2	5	3+1	50	50	100	50
2	ECE 1102	Fiber-Optic Communication Systems	3-0-2	5	3+1	50	50	100	50
3	ECE 1103	Advanced Digital Communication	3-0-2	5	3+1	50	50	100	50
4	ECE 1104	Digital System Design	3-0-2	5	3+1	50	50	100	50
5		Elective -I	3-0-0	3	3	50	50	100	----
6	ECE 1108	Research Seminar-I	0-0-3	3	2	----	----	----	50
Total			**15-0-11**	**26**	**21**	**250**	**250**	**500**	**250**

*Practical marks are for continuous and end semester evaluation

Elective-I
ECE-1105: Information Theory & Coding
ECE 1106: Modeling & Simulation of Communication Systems
ECE 1107: Advanced Mathematics

Year: First **Semester: Second**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1	ECE 1201	Embedded System Design	3-0-2	5	3+1	50	50	100	50
2	ECE 1202	Digital Image Processing	3-0-2	5	3+1	50	50	100	50
3	ECE 1203	Wireless & Mobile Communication	3-0-2	5	3+1	50	50	100	50
4		Elective-II	3-0-2	5	3+1	50	50	100	50
5		Elective-III	3-0-0	3	3	50	50	100	----
6	ECE 1213	Research Seminar-II	0-0-3	3	2	----	----	----	50
Total			**15-0-11**	**26**	**21**	**250**	**250**	**500**	**250**

*Practical marks are for continuous and end semester evaluation

Elective-II
(ECE-1204) Imaging and Additive Manufacturing
(ECE-1205) VLSI Design
(ECE-1206) Nano Electronics

Elective-II Lab
(ECE-1204) Imaging and Additive Manufacturing Lab
(ECE-1205) VLSI Design Lab
(ECE-1206) Nano Electronics Lab

Elective -III
(ECE-1207) Advanced Computer Networks
(ECE-1208) Satellite Communications
(ECE-1209) Design & Applications of New Materials
(ECE-1210) RF & Microwaves
(ECE-1211) Speech and Audio Processing
(ECE-1212) Adaptive Signal Processing

Year: Second Semester: Third

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical *
						Internal Assessment	University Assessment	Total	
1		Elective-IV	4-0-0	4	4	50	50	100	----
2		Elective-V	4-0-0	4	4	50	50	100	----
3	ECE 1309	Preliminary Thesis	0-0-20	20	10	----	----	----	100
Total			**8-0-20**	**28**	**18**	**100**	**100**	**200**	**100**

*Practical marks are for continuous and end semester evaluation

Elective- IV

(ECE-1301) Neural Network & Fuzzy Logic
(ECE-1302) Simulation & Modeling
(ECE-1303) Smart Systems Technologies
(ECE-1304) PLC & SCADA

Elective-V

(ECE-1305) Advanced Antenna Systems
(ECE-1306) Cryptography & Network Security
(ECE-1307) Research Methodology
(ECE-1308) Wireless Sensor Networks

Year: Second Semester: Fourth

S.No	Course Code	Course Name	Scheme of Teaching			Practical		
			L-T-P	Contact hrs/week	Credits	Internal Assessment	University Assessment	Total
1	ECE 1401	Thesis	0-0-25	25	15	100	100	200
Total			**0-0-25**	**25**	**15**	**100**	**100**	**200**

Internal Assessment of Thesis (ECE 1401) will be graded as follows:

S. No.	Grade	Requirement
1.	**A+**	Publication from Thesis in SCI/SCIE indexed Journal
2.	**A**	Publication from Thesis in Scopus/ESCI indexed Journal
3.	**B+**	Publication from Thesis in Proceedings of International/ National Conference

Total M.E. Marks: 2000 Total M.E. Credits: 75

M.E. Modular Programme

In each of the Modular programme, there are a total of 12 theory subjects, each of 100 marks (including sessional of 50 marks), 9 practical subjects, each of 50 marks, two research seminars, Preliminary Thesis and Thesis with a total of 1900 marks. A candidate will study 12 theory subjects in 1st to 6th spells; Preliminary Thesis work in 7th spell, and Thesis in 8th spell. The courses of study and evaluation scheme for ME Modular programme are the same as described for ME Regular programme and is detailed here.

Spell-1

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total hours	Univ Exam Theory	Int. Theory Marks	Int marks practical
ECE1101	Subject-1	15	0	11	3	1	26	50	50	50
ECE1102	Subject-2	15	0	11	3	1	26	50	50	50
	Total	30	0	22	6	2	52	100	100	100

Spell-2

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total hours	Univ Exam Theory	Int. Theory Marks	Int marks practical
ECE1103	Subject-1	15	0	11	3	1	26	50	50	50
	Elective -I	15	0	--	3	--	15	50	50	--
	Total	30	0	11	6	2	41	100	100	50

Elective-I

ECE1105: Information Theory & Coding
ECE1106: Modeling & Simulation of Communication Systems
ECE1107: Advanced Mathematics

Spell-3

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total hours	Univ Exam Theory	Int. Theory Marks	Int marks practical
ECE1104	Subject-1	15	0	11	3	1	26	50	50	50
ECE1201	Subject-2	15	0	11	3	1	26	50	50	50
	Total	30	0	22	6	2	52	100	100	100

Spell-4

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total hours	Univ Exam Theory	Int. Theory Marks	Int marks practical
ECE1202	Subject-1	15	0	11	3	1	26	50	50	50
ECE1203	Subject-2	15	0	11	3	1	26	50	50	50
	Research Seminar-I	-	-	11	-	2	11	-	-	50
	Total	30	0	33	6	4	63	100	100	150

Spell-5

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total hours	Univ Exam Theory	Int. Theory Marks	Int marks practical
	Elective-II	15	0	11	3	1	26	50	50	50
	Elective-III	15	0	0	3	---	15	50	50	--
	Total	30	0	11	6	1	41	100	100	50

Elective-II
(ECE1204) Imaging and Additive Manufacturing
(ECE1205) VLSI Design
(ECE1206) Nano Electronics

Elective-II Lab
(ECE1204) Imaging and Additive Manufacturing Lab
(ECE1205) VLSI Design Lab
(ECE1206) Nano Electronics lab

Elective -III
(ECE-1207) Advanced Computer Networks
(ECE-1208 Satellite Communications
(ECE-1209) Design & Applications of New Materials
(ECE-1210) RF & Microwaves
(ECE-1211) Speech and Audio Processing
(ECE-1212) Adaptive Signal Processing

Spell-6

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total hours	Univ Exam Theory	Int. Theory Marks	Internal marks Prac.
	Elective IV	15	0	0	4	---	15	50	50	-
	Elective V	15	0	0	4	---	15	50	50	-
	Research Seminar-II			11		2	11	--	--	50
	Total	30	0	11	8	2	41	100	100	50

Elective- IV

(ECE-1301) Neural Network & Fuzzy Logic
(ECE-1302) Simulation & Modeling
(ECE-1303) Smart Systems Technologies
(ECE-1304) PLC & SCADA

Elective-V

(ECE-1305) Advanced Antenna Systems
(ECE-1306) Cryptography & Network Security
(ECE-1307) Research Methodology
(ECE-1308) Wireless Sensor Networks

Spell-7

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total	Int. Marks	Univ Exam Marks
ECE1309	Preliminary Thesis			72	---	10	72	100	--
	Total			72	---	10	72	100	--

Spell-8

Code No.	Subject	L	T	P	Credit Th.	Credit Prac.	Total	Int. Marks	Univ Exam Marks
ECE1401	Thesis			101	---	15	101	100	100
	Total			101	0	15	101	100	100

Internal Assessment of Thesis (ECE 1401) will be graded as follows:

S.No.	Grade	Condition
1.	**A+**	Publication from Thesis in SCI/SCIE indexed Journal
2.	**A**	Publication from Thesis in Scopus/ESCI indexed Journal
3.	**B+**	Publication from Thesis in Proceedings of International/ National Conference

FIRST SEMESTER

Course Code	**ECE-1101**
Course Title	**ADVANCED DIGITAL SIGNAL PROCESSING**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Transform Theory:
Review of Z-Transform, Discrete Fourier Transform, Divide and Conquer approach for DFT, Introduction to Radix-2, Radix-4 and Split Radix FFT, Discrete Cosine Transform, DCT as Orthogonal Transform, Walsh Transform, Hadamard Transform, Time-frequency analysis, Wavelet Transform (6)

Digital Filters:
FIR Filter Design: Window method, Frequency Sampling method. Realization Structures
IIR Filter Design: Impulse Invariant, Bilinear transformation, Butterworth filter, Chebyshev filters. Realization Structures, Finite Word Length Effects in digital filters (8)

Multirate Digital Signal Processing:
Sampling Rate Alteration Devices and their frequency domain representation, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, Polyphase Decomposition, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform. (7)

SECTION-B

Linear Prediction and Optimum Linear Filters:
Forward and Backward Linear Prediction, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction. (6)

Adaptive Digital Filters:
Concepts of Adaptive Filtering, LMS Adaptive Algorithm, Recursive Least Squares Algorithm, Applications, Introduction to Active Noise Control (6)

Power Spectrum Estimation:
Nonparametric methods for Power Spectrum Estimation, Bartlett method, Welch method, Blackman and Tukey method, Parametric methods for Power Spectrum Estimation, Yule-Walker method, Burg method (5)

DSP Chips:

Introduction to fixed point and floating point processors, TMS320C6x series: Architecture, Instruction set, Memory, Addressing Modes, Interrupts, Applications. (6)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Signal Processing: Principles, Algorithms and Applications	Proakis & Manolakis	Pearson Education
RECOMMENDED BOOKS			
1	Digital Signal Processing	S.K.Mitra	Tata-Mcgraw Hill
2	Discrete Time Signal Processing	Oppenheim & Schafer	PHI
3	Digital Signal Processing: A Practical Approach	Ifeacher & Jervis	Pearson Education
4	Fundamentals of Digital Signal Processing using MATLAB	Robert J. Schilling & Sndra L. Harris	CENGAGE Learning
5	Modern Digital Signal Processing	Roberto Cristi	Nelson Engineering
6	Digital Signal Processing	Salivahanan, Vallavaraj & Gnanapriya	Tata-Mcgraw Hill
7	Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK	R Chassaing, and D Reay	Wiley India

Practice Task:

(Implement the following programs in MATLAB)

1. Convolution of Causal and Non Causal Sequences.
2. Circular Convolution.
3. DFT and FFT of Discrete time sequences.
4. Design of FIR Filters.
5. Design of IIR Filters.
6. Simulation of Digital Filters.
7. Analysis of Finite Word Length Effects using different Filter Structures.
8. Decimation and Interpolation of Discrete time sequences.
9. Implementation of an Arbitrary rate Sampling Rate Converter.
10. Illustrate Adaptive Filtering using LMS Algorithm.
11. Illustrate Adaptive Filtering using RLS Algorithm.
12. Enhancement of Narrowband signals buried in Noise using Adaptive Filters.
13. Illustrate Power Spectrum Estimation and Analysis using Welch method.
14. Illustrate Power Spectrum Estimation and Analysis using Burg method.
15. Illustrate Power Spectrum Estimation and Analysis using Yule-Walker method.
16. System Design based on chips.

Course Code	**ECE-1102**
Course Title	**FIBER-OPTIC COMMUNICATION SYSTEMS**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Objectives (CO)	1.To explain the need and significance of Optical Communication system. 2. To impart knowledge of types, basic laws, and transmission characteristics of optical fibers. 3. To study different lightwave systems, system components and applications. 4. To develop research interest and expertise in the field of WDM systems design.

SYLLABUS

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SECTION-A

Review of Optical Fiber Communication: 6

Need of optical transmission, Fiber optic communication system, Advantage of OFC, Basic optical laws and transmission parameters, Geometrical optics description: Step Index Fiber & Graded Index Fiber, Mode Theory for optical propagation, Modes in planar wave, Phase & Group Velocity.

Signal Degradation in OFS: 9

Attenuation, Material Absorption, Scattering Loss, Bending Loss, Information Capacity Determination, Group Delay, Material Dispersion, Waveguide Dispersion, Higher order Dispersion, Polarization Mode Dispersion, Dispersion compensating fibers, Non-linear effects on network performance (SPM, SRS, SBS, XPM & FWM).

Optical Transmitter: 7

Basic Concept: Emission and absorption Rates, p-n junctions, Non-radiative recombination, semiconductor materials, LED: Power current relationship, LED spectrum, LASER Diodes, ILD & its characteristics, Optical Gain, Feedback and Laser threshold, working principle of Distributed feedback lasers & VCSEL.

SECTION-B

Optical Receivers: **6**

Optical detection principles & devices, Detection response time, p-i-n photo-diode, Avalanche photodiode, Receiver operation: Digital Transmission, Error sources, Receiver configuration, Digital receiver performance, Probability of error.

Transmission System Design **8**

Link power budget, Rise time budget, Modulation Formats: Direct and External Modulation, need for modulation/encoding, NRZ, RZ, CSRZ, DPSK, QAM modulation formats. Fiber Loss-Induced Limitations, Balanced Coherent Receiver, Dispersion-Induced Limitations, ASE-Induced Limitations, Equivalent Noise Figure, Impact of Amplifier Spacing, Direct Detection Receiver.

Optical Amplifier: **4**

Basic application and types of optical amplifiers, Semiconductor optical amplifiers, Erbium doped fiber amplifiers: architecture and types, Raman Amplifier, Amplifier-noise.

Optical Components & Networks: ***5***

Coupler/splitter, optical switches, optical add/drop multiplexers, fiber grating, WDM & DWDM systems, optical CDMA & TDMA.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Optical Fiber Communications	Gerd Keiser	third edition, Mc Graw Hill
2	Fiber optic communication technology	D.F Mynbaev and L. Scheiner	Pearson Education
RECOMMENDED BOOKS			
1	Fiber optic communication systems	Govind P. Agrawal	third edition, Wiley India
2	Fiber Optic Communications: Fundamentals and Applications	Shiva Kumar, M. Jamal Deen	Wiley Publication
3	Free Space optical networks for ultra broad band services	Stamatios V. Kartalopoulos	Wiley Publication
4	optical wireless communications: system and channel modeling with MATLAB	Z. Ghassemlooy, W. Popoola, S. Rajbhandari	CRC Press

Practical task:

1. Simulation exercise on comparison of different dispersion compensation techniques : Pre-DCF, Post-DCF and symmetric dispersion compensation.
2. Simulation exercises on the designing on WDM systems and performance evaluation through eye diagram, optical spectrum, OSNR, Q-factor & BER rate .
3. Simulation exercises on the designing of Free Space Optics communications.

Course Code	**ECE-1103**
Course Title	**ADVANCED DIGITAL COMMUNICATION**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Elements of a Digital communication system **5**

Communication channels and their characteristics, mathematical models for communication channels, recent trends in digital communication, Deterministic and Random Signal Analysis**,** Band pass and Low pass Signal Representation, Signal space representation of waveforms.

Digital modulation Schemes **10**

Representations of digitally modulated signals, memory less modulation methods, PAM,PM,QAM, multidimensional signaling, Signaling scheme with memory, CPFSK,CPM, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signals with memory, PSD of linearly modulated signals.

Optimum Receivers for Additive White Gaussian Noise Channels **10**

Waveforms and vector channel models, waveforms and Vector AWGN channels, Optimum detection for the Vector AWGN channel, Implementation of the optimal receiver for AWGN channels, the correlation receiver, matched filter receiver, frequency domain interpretation of the matched filter, Performance analysis of wire-line and radio communication systems.

SECTION-B

Carrier and symbol synchronization **8**

Signal parameter estimation, the likelihood function, carrier recovery and symbol synchronization in signal demodulation, carrier phase estimation, maximum likelihood carrier phase estimation, phase locked loop, effect of noise on the phase estimation, symbol timing estimation, maximum likelihood timing estimation , non–decision directed timing estimation.

Multichannel and Multicarrier System **8**

Multichannel Digital Communication in AWGN channels, binary signals, M-ary orthogonal signals,Multicarrier communication, single-carrier versus multicarrier modulation, Capacity of a Nonideal linera filter channel, orthogonal frequency division multiplexing (OFDM), modulation and demodulation in an OFDM system, Spectral characteristics of multicarrier

signals, Bit and Power allocation in multicarrier modulation.

Spread Spectrum Signals for Digital Communication **4**

Model of spread spectrum digital communication system, direct sequence spread spectrum signals, frequency hopped spread spectrum signals, CDMA system based on FHSS signals, Synchronization of spread spectrum systems.

Practical Task:

1. Digital Modulation techniques using MATLAB
2. Study of Spread spectrum signals
3. Simulation of digital communication system

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Communications	JG Proakis & M Salehi	5th Edition McGraw Hill
2	Digital Communication	Simon Haykins	John Wiley & Sons
RECOMMENDED BOOKS			
1	Principle of Communication systems	Taub & Schilling	Tata Mc Graw Hill
2	Digital Communications: Fundamentals and applications	Bernard Sklar	Prentice Hall Publications

Course Code	**ECE-1104**
Course Title	**DIGITAL SYSTEM DESIGN**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Objectives(CO)	1. To understand theoretical and practical aspects of all the combinational & sequential circuits. 2. Ability to identify and design the code using different modeling styles and synthesize the VHDL code. 3. Acquired knowledge about FSM and how to design a code for FSM. 4. To understand the future outlook and challenges for designing of digital system.

SYLLABUS

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SECTION-A

Introduction to Digital Design Concepts:
Design Constraints and Logic Representation of System. (02)

Analog interfacing:
A/D conversion concepts, Analog & Digital Conversion related errors. (03)

Combinational Logic Design and Implementation:
Multiplexer/Decoder, PLA/Pal/GAL,ROM,CPLD and FPGA level customized design, ALU, VHDL models and simulations of combinational circuits. (18)

SECTION-B

Sequential Logic Design and Implementation:
Practical Synchronous and asynchronous circuit design. Design and Implementation of sequential digital system, state representation, analysis of digital systems, synchronization, design criteria, design procedure. High level modeling of digital systems, controller realization, Timing & Frequency consideration, system examples. VHDL models and simulation of sequential circuits (18)

Design for Testability:

Fault and Fault coverage in digital circuits, internal scan test methodology, BIST and Boundary scan (JTAG) techniques. (04)

Practice Task:
Practical tasks related to theory.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Design principles and practices	J.F.Wakerly	
2	Principles of Digital Design	Daniel D.Gajaski	Prentice Hall
RECOMMENDED BOOKS			
1	Combinational design & testing using PLA/PAL/ROM chips		
2	Combinational design, simulation, synthesis & implementation		
3	An Engineering Approach to Digital Design	W.J.Fletcher	
4	Digital Design	M. Morris Mano	
5	Digital Systems-Principles and applications	Ronald Tocci	

ourse Code	**ECE-1105**
Course Title	**INFORMATION THEORY & CODING**
Type of Course	Elective-I
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

The Communication process and the nature of information. (02)

Information Sources, measurement of information and the Entropy Function:
Entropies defined, and why they are measures of information, marginal entropy, joint entropy, Conditional entropy and the Chain Rule for Entropy. (06)

Sources with and without Memory:
Sources coding theorem, Prefix, Variable and Fixed- length Codes. Error Correcting Codes. (06)

Channel Types, Properties, Noise and Channel Capacity:
Perfect communication through a noisy channel. The binary symmetric channel, their classification and capacity of a noiseless discrete channel. The Hartley and Shannon laws for channel capacity. (08)

SECTION-B

Continuous Information; Density; Noisy Channel Coding Theorem:
Extensions of the discrete entropies and measures to the continuous case. Signal-to-noise ratio; power spectral density, Gaussian channels, Relative significance of bandwidth and noise limitations. The Shannon rate limit and efficiency for noisy continuous channels (06)

Error Control Coding:
Linear blocks codes and their properties, hard-decision decoding, cyclic codes, Convolution codes, Soft-decision decoding, Viterbi decoding algorithm. (08)

Advanced Coding Techniques and Cryptography:
BCH codes, Trellis coded modulation, introduction to cryptography, overview of encryption techniques, symmetric cryptography, DES, IDEA, asymmetric algorithms, RSA algorithm. (09)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Information Theory, Coding and Cryptography	Ranjan Bose	Tata McGraw Hill
RECOMMENDED BOOKS			
1	Applied Coding and Information Theory for Engineers	Richard B. Wells	Pearson
2	Coding and Information Theory	R.W.Hamming	2nd edition, Prentice Hall
3	Information Theory and Reliable Communication	R.G.Gallager	Wiley
4	The Theory of Information and Coding.Addison	R.J. McEliece	Wesley
5	Introduction to information Theory	M.Mansuripur	Prentice Hall,1987
6	Principles of communication	Taub & Schilling	McGraw Hill
7	Elements of Information Theory	Thomas Cover & Joy Thomas	John Wiley & Sons

Course Code	**ECE 1106**
Course Title	**MODELING AND SIMULATION OF COMMUNICATION SYSTEMS**
Type of Course	Elective-I
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Modelling Of Communication System

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system Models.

Simulation of Random Variables And Random Process

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

SECTION-B

Estimation of Performance Measures

Quality of an estimator, estimator of SNR, Probability density functions of analog communication system, BER of Digital communication systems, Montre Carlo method and Importance sampling method, estimation of power, Spectral density of a process

Communication Networks

Queuing models, M/M/I and M/M/I/N queues, little formula, Burke's theorem/G/I queue, Embedded Markov Chain analysis of TDM systems, Polling, Random access systems

Network of Queues

Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flow Chart, Routing model, Network layout and Reliability

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Simulation Modelling and analysis	A.M.Law and W.David Kelton	Mc Graw Hill Inc., New York.
2	Modeling and Analysis of Computer Communication networks	J.F.Hayes	Plenum Press, New York.
3	Discrete-event system Simulation	Jerry Banks and John S.Carson	Prentice Hall, Inc., NewJersey.

Course Code	**ECE 1107**
Course Title	**ADVANCED MATHEMATICS**
Type of Course	Elective-I
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Series solution of differential equations, Power series methods, Legendre's polynomial, Generating functions, Recurrence relations. 8

Frobenius method, Series solution of Bessel's differential equation, Modified Bessel's functions, Generating functions, Recurrence relations. 8

Equations reducible to Bessel's equation. 4

Sturm Liouville's problem, orthogonal functions, Orthogonality of eigen functions, Eigen function expansions. 6

SECTION-B

Conformal mapping, Exponential function ,Trigonometric functions, Hyperbolic functions, Inverse trigonometric functions, Logarithmic function, Power function, Bilinear and Schwarz-Christoffel transformation, Applications to engineering problems. 8

Matrices, Functions of square matrices, Quadratic and Hermitian forms, Solution of linear simultaneous equations by Gaussian elimination and its modifications, Crout's triangularization method, Iterative method's-Jacobi's method, Gauss-Seidel method, Eigevalue by iteration. 10

System simulation, Technique of simulation, Monte Carlo method, Comparison and simulation with analytical method, Numerical computation techniques. 8

RECOMMENDED BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Advanced Engineering	Wylie and Barren	Mcgrawhill,6th

	Mathematics		edition,1995
2	Higher Engineering Mathematics	B.S. Grewal	Khanna Publications
3	System Simulation with Digital Computer	Narsingh Deo	Prentice Hall of India
4	Advanced Engineering Mathematics	Kreyszig, John Wiley and Sons	8th edition,2001
5	System Simulation	Geoffrey Gordon	Prentice Hall of India
6	Engineering Mathematics	Bali &lyingar	Laxmi Publication

SECOND SEMESTER

Course Code	**ECE-1201**
Course Title	**EMBEDDED SYSTEM DESIGN**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction to Embedded System:

Their classification & characteristics, Concepts and Processes of system level design of embedded system. (04)

Microcontrollers:

Introduction to PIC 16F8XX Flash Microcontrollers, CPU architecture, Register file structure, Instruction Set, Programs, Timers and Interrupts, Interrupt Service Routine, Features of Interrupts, Interrupt vector & Priority, Timing Generation & Measurements, Interfacing Methods, I/O Interface, LCD interfacing, Seven segment interfacing, I^2 C Bus, DAC, ADC, UART. (11)

Program Modeling Concepts in Single and multiprocessor system Software- Development Process:

Modeling Processes for software Analysis before software implementation, Program model for event controlled, Modeling of Multiprocessor Systems. (08)

SECTION-B

Embedded Core Based Design:

System-on-Chip, Application specific Integrated circuit, Overview of Embedded Processors like ARM, MIPS and Intel MMX series, Architecture, Organization and instruction set, Memory management, High level logic synthesis. Data parallel issues e.g SIMD, MIMD, MISD, SISD. Introduction to FPGA, Basics of FPGA, RTOS overview (15)

Applications of Embedded Systems in Embedded Networking

Introduction to Wireless Sensor Networks, Architecture of Wireless Sensor Node, Characteristics, Challenges and Embedded Applications of Wireless Sensor Networks.

(07)

Practice Task:

1. Write a program to operate LED with the help of PIC controller
2. Write a program to control LED with a switch using PIC controller
3. Write a program to implement 8 bit binary counter using PIC
4. Write a program to interface seven segment display with PIC
5. Write a program to implement macros in any software
6. Write a program to implement ADC using PIC
7. Write a program to interface keypad with PIC
8. Write a program to use INT0 interrupt in PIC
9. Implementation on FPGA

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Microcontrollers (Theory and Applications)	Ajay V. Deshmukh	
2	An Embedded System Primer	David E. Simon	
3	Embedded system Design	Steve Heath	
4	PIC Microcontroller	John B. Peatman	
5	ARM system architecture	Steve Furber	Addison Wesley
6	Programming Embedded System in C/C++	M.Barr	
7	Real Time Systems	H. Kopetz	
8	Embedded Systems	Raj Kamal	
9	Embedded Systems	K. V. Shibu	
10	Wireless Sensor Networks, Technology, Protocols and Architecture	Kazim Soharby	

Course Code	**ECE-1202**
Course Title	**DIGITAL IMAGE PROCESSING**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Introduction:

Fundamental concept of digital image processing, Fields of Digital Image Processing, Component of image processing system, Image sensing and acquisition. (02)

Image Transformation, Filtering and Restoration:

Relationship between pixels, Mathematical Tools used in image processing, Intensity Transformation Functions, Histogram Processing, Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Filtering in frequency domain, Image smoothing using low-pass frequency domain filters, Image sharpening using high-pass frequency domain filters.

Noise Models, Restoration in the presence of noise and degradations, Inverse Filtering. (10)

Color Image Processing

Color Fundamentals, Color Models, Color Transformations, Color Image Smoothing and Sharpening, Color in image segmentation, Noise in color images. (03)

Wavelets and Other Image Transforms

Matrix based transforms, Correlation, Basis functions in time-frequency plane, basis images, Fourier related transforms, DHT, DCT, DST, Walsh Hadamard transforms, Slant transform, Haar transform, Wavelet transform: scaling functions, wavelet functions, wavelet series expansion, DWT in one dimension, Wavelet Transform in two dimensions, Wavelet Packets. (08)

SECTION-B

Image Compression

Redundancies in Images, Huffman Coding, Arithmetic coding, Symbol based coding, Bit-plane coding, Block Transform coding, Predictive coding, Wavelet Coding, Digital Image watermarking. (05)

Morphological Image Processing

Erosion and Dilation, Opening & Closing, Basic Morphological Algorithms: Boundary & Region Extraction, Convex Hull, Thinning, Thickening, Skeletons, Pruning. (05)

Image Segmentation & Representation

Point, Line and Edge Detection, Thresholding, Region growing, Region splitting and merging, Clustering and Superpixels, Boundary preprocessing and feature descriptors, Region feature descriptors, SIFT. (06)

Digital video Processing

Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X. (06)

Practice Task:

(Based on MATLAB)

1. Intensity transformation
2. Histogram Processing.
3. Spatial Filtering.
4. Frequency Domain Processing.
5. Image Restoration.
6. Image Denoising
7. Color Image Processing
8. Wavelet & Other Transforms
9. Image Compression
10. Morphological Image Processing
11. Point, Line and Edge Detection
12. Image Segmentation
13. Image Representation and Description
14. Video Processing

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Image processing	R.C. Gonzalez and R.F.Woods	Pearson Education
RECOMMENDED BOOKS			
1	Fundamentals of Digital Image Processing	A.K Jain	
2	Digital Image Processing	W. K. Pratt	
3	Digital Image Processing using MATLAB	Woods & Gonzalez	Pearson Education
4	The Image Processing Handbook	John C. Ruses	Fourth Edition
5	Digital Video Processing	Murat Tekalp	Prentice Hall, 2nd edition, 2015
6	Algorithms for image Processing and Computer Vision	James R.Parker	

Course Code	**ECE-1203**
Course Title	**WIRELESS & MOBILE COMMMUNICATION**
Type of Course	Core
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Mobile Communication:
Types of Mobile Communication Systems, Mobile radio systems around the world, Trends in cellular radio and personal communications. (03)

Cellular Design Fundamentals:
Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, mechanism for capacity improvement-cell splitting, cell sectoring, and micro cell zone concept. (05)

Multiple access schemes : TDMA, FDMA, CDMA, WCDMA, OFDMA, Random Multiple access Scheme, Packet Radio Protocols, CSMA, Reservation Protocols, Capacity of Cellular systems. (09)

GSM Architecture& Protocols, GSM Burst structure, Carrier and Burst Synchronization, Design Consideration, Security Aspects, Power Control strategies. (06)

SECTION-B

CDMA Digital Cellular Standards, Services and Security Aspects, Network Reference Model and Key Features, Advantages over TDMA, CDMA WLL System. (05)

Multipath Propagation: Fading, Large scale path loss, reflection, Diffraction, Scattering, Outdoor Propagation model-Okumura Model, Hata Model, Indoor Propagation Models. Small-scale multipath propagation, Types of small scale fading, Rayleigh and Ricean distributions, Diversity Schemes. (11)

Wireless Networks:
WiFi, WiMax, Bluetooth, Long Term Evolution (06)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Wireless Communication	Rappaport	PHI
RECOMMENDED BOOKS			
2	Mobile and personal Communication Systems and services	Raj Pandya	PHI

3	Mobile Communication	Lee	TMH
4	Wirelesss & Mobile System	Dharam Prakash Aggarwal, Qing-Anzeng	Thomson

Practice Task (Perform at-least five of the following):-

1. Simulation and implementation of baseband digital signals

   (i) Types of baseband signals: unipolar, polar, bipolar, RZ, NRZ, etc.
   (ii) Distortion and noise, Eye diagram.

2. Simulation and implementation of modulated digital signals

   (i) PSK, ASK and FSK modulations.
   (ii) Quadrature modulations (QASK and QPSK).
   (iii) QAM modulation.

3. Global System for Mobiles (GSM)

   (i) Cellular telephony. GSM Architecture.
   (ii) Radiofrequency. Traffic and control channels. Frames.
   (iii) AT Commands
   (iv) Working of GSM mobile station.

4. Channel Characteristics

   (i) Multipath channel propagation characteristics

   (ii) Bit-error rate measurement

5. Wireless Networks

   (i) Bluetooth wireless network.

   (ii) Wi-Fi

6. Educational field visit to a Mobile Switching Center (MSC)

7. Study of Cellular Tower –offering public services.

Course Code	**ECE-1204**
Course Title	**IMAGING AND ADDITIVE MANUFACTURING**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Objectives(CO)	To understand the complete process of image capturing and developing complex high precision structures through additive manufacturing.

SECTION-A

1. Introduction And Digital Image Fundamentals: The origins of Digital Image Processing Examples of Fields that Use Digital Image Processing Fundamentals Steps in Image Processing Elements of Digital Image Processing Systems. Elements of digital image processing, Image model, Sampling and quantization, Relationships between pixels 10

2. Converting Between data classes and Image Types Introduction to M Function Programming using MATLAB • Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations Histogram Processing, o Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, Hadamard Transform, Enhancement by point processing, Spatial filtering, Enhancement in the frequency domain, Color Image Processing 10

3. Image Segmentation, Discontinuity detection, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion for segmentation 5

SECTION-B

4 Multispectral Image Analysis - Color Image Processing Three Dimensional Image Processing-Computerized Axial Tomography-Stereometry-Stereoscopic Image Display-Shaded Surface Display Image Restoration: A model of The Image Degradation / Restoration Process Project: Part 2 Digital Image Page 6 of 7 Noise Models Restoration in the presence of Noise Only Spatial Filtering Processing Application Some basic morphological algorithms, Extensions to gray level images 5

5 2D & 3D Transformations of geometry: Translations, Scaling, Reflection, Rotation, Homogeneous representation of transformation, Concatenation of transformations, Perspective, Axonometric projections, Orthographic and Oblique projections. Polymer and Photopolymerization, (SLS), LCVD, DMD. 5

6 Design of Surfaces: Differential geometry, Parametric representation, Curves on surface, Classification of points, Curvatures, Developable surfaces, Surfaces of revolution, Intersection of surfaces, Surface modelling, 16-point form, Coons patch, B-spline surfaces. Design of Solids: Solid entities, Boolean operations, B-rep of Solid Modelling, CSG approach of solid modelling, Advanced modelling methods. Data Exchange Formats and CAD Applications: Data exchange formats, Finite element analysis, reverse engineering, modelling with point cloud data, Rapid prototyping. 3D Scanning and Digitizing Devices CAD Model Construction from Point Clouds, Data handling & Reduction Methods, AM Software (Magics, Mimics, 3Matic, Rhino) Tessellated Models, STL File Problems, STL File Manipulation and Repair Algorithms, Role of Rapid Solidification 15

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Image Processing	Kenneth R Castleman	Pearson Education
2	Digital Image Procesing	S. Jayaraman, S. Esakkirajan, T. Veerakumar	McGraw Hill Education 2009
3	Geometric Modeling	Michael E. Mortenson	Wiley, NY 1997
4	Computer Aided Engineering Design	Anupam Saxena, Birendra Sahay	Springer,2005

Imaging and Additive Manufacturing Lab

List of Experiments
(Based on Theory Classes)

Course Code	**ECE-1205**
Course Title	**VLSI DESIGN**
Type of Course	**Elective**
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Introduction to VLSI:

Introduction to solid state electronics, CMOS Logic, VLSI Design Flow.

MOS FET theory: Ideal V-I Characteristics, C-V Characteristics, Non-ideal I-V Characteristics,

CMOS processing technology: P-well, N-well, Twin Tub and silicon on Insulator processing, layout Design rules, CMOS Process enhancement. (10)

CMOS Circuit and Logic design:

Combinational Circuit Design: Introduction, circuit Families like static CMOS, Ratioed circuits, CVSL, Dynamic Circuits, Pass Transistor circuit,.

Sequential Circuit design: Sequencing methods, Max-Delay constraints, Min-delay constraints, time borrowing, and clock skew.

Data Path Subsystems: Adders, Sub tractors, Comparators, flip-flops, Shifter, counters, Multiplier (12)

SECTION-B

Design Methodology & Tools:

Design Methodology: Introduction, structured Design, Programmable logic, fully Custom design, CAD tools in VLSI Design Process.

Floor Planning: Introduction, Block Placement and Channel Definitions, Global Routing, Switchbox routing, Power Distribution, clock Distribution.

Architecture Design: Introduction, HDLs, High level synthesis, Logic Synthesis. (11)

VLSI Simulation and Algorithm:

Hierarchy of simulation tools, Switch level simulations, Layout synthesis, Placements and routing algorithms, spice simulation. (12)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	CMOS VLSI design	Neil H.E. Weste, David Harris, Ayan Banerjee	Pearson Education
2	Modern VLSI Design	Wayne Wolf	Pearson education
3	FPGA-Based system design	FPGA-Based system design	Pearson Education
4	Introduction to VLSI Systems	Mead and Conway	Addison wisely
5	VLSI Design	Puckneel	

ECE-1205 **VLSI DESIGN Lab**

Practice Task:

Design & Simulation of combinational and sequential circuits using

1. Front End VLSI tools like Xilinx ISE, ISE simulator or Modelsim simulator.
2. Back End VLSI Tools like Microwind, Mentor Graphics, Synopsis, Cadence.

Course Code	**ECE-1206**
Course Title	**NANO ELECTRONICS**
Type of Course	**Elective**
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Materials for Nano-Electronics:

Crystal lattices, Bonding in Crystals, Electron energy bands, Semiconductor: Si, Si-Ge, Hetrostructures. Strained Si, III-V Semiconductors, Carbon- Nano- tube, Silicon nanowires. (08)

Properties of Individual Nanoparticles:

Introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, preparation of quantum nanostructures, Introduction to carbon nano tubes, Fabrication, Structure, Electrical properties, vibrational properties, Mechanical properties. (08)

Bio-logical Materials:

Biological building blocks-polypeptide, nucleic acids- DNA, Biological nanostructure, Biological methods for Nano scale fabrication.

(08)

SECTION-B

Tools:

TEM, Infrared and Raman Spectroscopy, Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force microscopy, Magnetic force microscopy. (06)

Nano-scale Devices

Introduction, Nanoscale MOSFET-Planer and non-planer, Resonant-tunneling diodes, Single electron transistor, Quantum-dot Nano-electromechanical systems, Molecular/Bio molecular electron devices.

(15)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Introduction to Nanotechnology	C.P.Polle and F.J.Owens	John Wiley & Sons, 2003
2	Nano-technology: a gentle introduction to the next big idea	M.A.Rather & D.Rather	Prentice Hall, 2003
3	Nanometer Structures: Theory, Modeling and Simulation	Akhlesh Lakhtakia	ASME Press, 2004
4	Nano and Micro-electromechanical systems fundamentals of nano and micro- engineering", 2nd Edition	S.E.Lyshevski	CRC Press, 2004.
5	Nano-Systems	K.E. Drexler	Wiley (1922)
6	Nano-Electronics & Information Technology	Waser Ranier	Wiley (2003)

Course Code	**ECE-1207**
Course Title	**ADVANCED COMPUTER NETWORKS**
Type of Course	**Elective**
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Overview:
Computer Network, Network Hardware and Software, Network Topologies, LAN, MAN, and WAN, The OSI reference model, TCP/IP reference model, Addressing, Circuit Switched, Datagram and Virtual Circuit Networks, Hubs, Bridges, switches, Routers and Gateways, Transmission Media and Impairments. (04)

Data Link Layer:
Design Issues, Error Control, Flow-control protocols: Stop-and-wait, and Sliding-window. Link protocols: HDLC, SLIP, and PPP Protocols. (05)

Local/ Personal Area Networks:
IEEE LAN standards: Ethernet (802.3), Gigabit Ethernet, Wireless LAN (802.11), Bluetooth, and Broadband Wireless (802.16). (05)

Wide Area Networks: X-25, Frame Relay, ATM**.** (04)

Network Layer:
Routing Algorithms: Shortest path routing, Flooding, Distance-vector routing, Link- state routing, Hierarchical routing, Broadcast routing and Multicast routing.
Congestion control: Principles and policies congestion control in Virtual-circuit and Datagram subnets. Load shedding and Jitter control.
Quality of Service: Techniques for achieving good Quality of Service, Integrated Services, Differentiated Services, Label Switching and MPLS. (08)

SECTION-B

Internetworking and Internet Protocols:
Tunneling, Fragmentation. The IPv4 Protocol, IPv4 addresses, IPv6 Protocol, Mobile IP, OSPF, BGP, ARP, DHCP, Internet Control Protocols, Classless Inter-domain Routing (CIDR), Network Address Translation (NAT), Subnetting and Supernetting. (08)

Transport Layer:
Transport layer protocol issues: Addressing, Connection Establishment, Connection Release, Flow control and Multiplexing. Internet Transport Protocols: TCP and UDP. (05)

Network Applications:
DNS, Electronic Mail, TELNET, FTP, SNMP, World-wide Web, Multi-media. (06)

Network Security:

Introduction to Network Security, Cryptography, Symmetric-key and Asymmetric Key Algorithms, Digital Signatures. (05)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Data Communications And Networks, 2nd Ed	Forouzan	Tata Mcgraw Hill
RECOMMENDED BOOKS			
1	Data And Computer Communications, 7th Ed	William Stallings	Pearson Education
2	Computer Networks, 4th Ed	A. S. Tanenbaum	Pearson Education
3	Computer Networks And Internets. 2nd Ed	Comer, D.E	Delhi: Pearson Education Asia, 1998.
4	An Engineering Approach To Computer Networking: Atm Networks, The Internets, And The Telephone Network	Keshav, S.	Addison- Wesley Professional Computing Series, Awl International Student Edition, 1997 Ed
5	Principles Of Wireless Networks, 2002	Pahlavan, K. And Krishna Murthy	Delhi: Pearson Education
6	High-Speed Networks And Internets: Performance And Quality Of Service.2nd Ed	Stallings, W	Delhi: Pearson Education Asia, 2002
7	Encyclopedia Of Networking	Sheldon, Tom	TMH
8	Tcp/Ip Illustrated, Vol. 1: The Protocols	Stevens, R.W	Addison-Wesley

Course Code	ECE-1208
Course Title	SATELLITE COMMUNICATIONS
Type of Course	**Elective**
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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Section-A

Unit-I: Communication Satellite: Orbit and Description

A Brief history of satellite Communication, Satellite Frequency Bands, Satellite Systems, Applications, Orbital Period and Velocity, effects of Orbital Inclination, Azimuth and Elevation, Coverage
angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit.

Unit-II:: **Satellite Sub-Systems**

Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem, Power systems,
Communication subsystems, Satellite Antenna Equipment.

Satellite Link

Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference
Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use).

Section-B

Unit-III: Propagation effects

Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospeheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference.

Unit-IV :GPS Principles: History of Navigation, GPS Constellation, Principle of operation, GPS Orbits, Orbital mechanics and Satellite position determination, Time reference, Various DOPs, signal structure, Code and carrier phase measurements, position estimation with pseudorage measurements. GPS applications

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Satellite Communications, 2nd Edition, 1990	Tri.T.Ha	Mc.Graw Hill
2	Satellite Communications, 2nd Edition, 2003	Timothy Pratt, Charles Bostian, Jeremy Allnutt	John Wiley&Sons.
3	Satellite Communications, 2nd Edition, 1996	Dennis Roddy	Mc-Graw Hill.

Course Code	ECE-1209
Course Title	**DESIGN & APPLICATIONS OF NEW MATERIALS**
Type of Course	**Elective**
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Objectives (CO)	To realize the important of materials used for developing different engineering applications related to medical, structural, defence needs etc.

SYLLABUS

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SECTION-A

Nano -materials: 12

Definition, historical perspective, effects of nano science and nanotechnology on various fields; Application and synthesis of CNTs. Materials selection and related factors such as design, processing and economics; case histories related to CNT selection. Classification of nano-structured materials.

Bio-Nano materials, top down and bottom up approaches of generation, Mechanical properties of nano-materials; other important properties of nano-structured materials. Study of micromechanics, additional strength, theory, perforated and notched composites, experimental techniques, fracture, manufacturing and processing, structural mechanics/vibration, nanomaterials, smart structures/systems/materials.

Engineering polymers and ceramics: 10

Thermoplastic, thermosetting polymers and elastomers; High strength engineering ceramics. Advanced analysis of composite materials; anisotropic elasticity; behaviour of composite plates and beams under bending, buckling, and vibration; advanced

elasticity solution techniques; thermal behaviour of polymer composites; strength prediction theories and failure mechanisms in composites.
Introduction, synthesis and application of Transparent Ceramics.

SECTION-B

Fabrication methods: 8

Fundamentals of rheology and visco-elasticity of polymer solution and metal; Master curve and its use for design of polymer parts: polymer fabrication by techniques such as compression, moulding, extrusion, calendaring, thermoforming, injunction moulding, reaction injection moulding (RIM), blow moulding etc. Compounding of plastics and role of additives in processing.

Introduction to Finite Element Method : 6

Basic concept, Historical background, engineering applications, general Description, Comparison with other methods.

Finite Element Techniques: 9

Model boundary value problem, finite element discrete element shapes, sizes And node locations, interpolation functions, derivation of element equations, connectivity, boundary conditions, FEM solution, post-processing, Compatibility and completeness requirements, convergence criteria, higher order and isoparametric elements, natural coordinates, Langrange and Hermit Polynomials.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Material Science and Engineering – An Introduction, 5th Ed.	Callister, W.D. Jr.	John Wiley and Sons 2000
2	The Science and Engineering of Materials, 2nd Ed.	Askland, R.A	PWS-KENT Publishing Company.1989
3	Engineering Physical Metallurgy	Lakhtin Y	Mir Publishers Co.1992
4	Introduction to Physical Petallurgy	Avner S.H	McGraw Hill Book 2005
5	Materials Science and Engineering: A First Course, 5^{th} Ed.	Raghavan, V	Prentice-Hall of India. 2004

Course Code	**ECE-1210**
Course Title	**RF AND MICROWAVES**
Type of Course	**Elective**
L T P	3-0-0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Review of boundary conditions: Wave-guides and Cavity resonates (rectangular, circular & cylindrical) passive Circuits (design principles), impedance transformers, filters, hybrids, isolates. Detail discussion on S-matrix. (10)

High frequency semi-conductor devices: Intel valley Scattering, Gunn diodes, IMPATT diodes, Step recovery diodes. Lumped elements: Equivalence circuits of Capacitors and Inductors, Design of lumped element resonators and circuits, Basic blocks in RF system and their VLSI implementation, Design of mixer, Basic topologies VCO and phase noise, Various RF Synthesizer architecture and frequency dividers, Design issues in integrated RF filters. Thin & Thick film technologies. (13)

SECTION-B

Design aspects: Transmission lines fir microwave circuits, Strip lines, Micro-strip lines, Slot line & Coupled lines. Characteristics impedance, Lumped parameters etc. Design considerations and implementation using simulation tools, Design of power dividers, combiners, and directional couplers (08)

Microwave measurements: SWR, Return loss, impedance, Scattering parameters, attenuation and familiarization with equipments such as vector network analyzer, Spectrum analyzer, power meters and their block diagrams discussion. Fabrication techniques in microwave. (10)

Computational techniques for microwave: moment method & Finite difference time Domain method. Comparison of Simulation Software for microwave applications. Computer aided design.

(10)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Stripline- Loke Transmission lines for MICS	B.Bhat & S.koul	John Wiley
2	Hand book of Microwave Technology, Vol.1	T.K. Ishii	Academics Press
3	Microwave integrated Circuit	Y.Konishi	Marcel Dekker
4	Microwave Circuit Analysis and Amplifier Design	S.Y.Liao	PHI
5	RF Micro-Elements	B.Razavi	PHI

Course Code	ECE-1211
Course Title	**Speech and Audio Processing**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	
Course Outcome	1. Mathematically model the speech signal 2. Analyze the quality and properties of speech signal. 3. Modify and enhance the speech and audio signals.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt any two questions from each part*

SECTION-A

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. (6 hours)

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. (3 hours)

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction. (7 hours)

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. (6 hours)

SECTION-B

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. (6 hours)

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model. (6 hours)

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP (8 hours)

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards (3 hours)

TEXT BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Digital Speech	A.M.Kondoz	Wiley Students Edition
2	Speech Coding Algorithms: Foundation and Evolution of Standardized Coders	W.C. Chu	WileyInter science, 2003.

Course Code	**ECE-1212**
Course Title	**Adaptive Signal Processing**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Signal Processing
Course Objectives (CO)	
Course Outcome	1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation. 2. Mathematically represent the 'adaptability requirement'. 3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

SYLLABUS

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt any two questions from each part.*

SECTION-A

General concept of adaptive filtering and estimation (12)

Applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices. Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error, correlation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm (11)

The sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

SECTION-B

Vector space of random variables (11)

Correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS) (11)

Vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

RECOMMENDED BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Adaptive filter theory	Simon Haykin	Prentice Hall, 1986.
2	Adaptive signal processing	C. Widrow and S.D. Stearns	Prentice Hall, 1984.

THIRD SEMESTER

Course Code	**ECE-1301**
Course Title	**NEURAL NETWORKS & FUZZY LOGIC**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Fundamentals of Neural Networks:

Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN – Training, Learning and Generalization. (10)

Supervised Learning:

Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules. Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feed-forward Network, Radial- Basis Function (RBF) network & its learning strategies. (15)

SECTION-B

Unsupervised Learning:

Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's Self-organizing Maps. (09)

Neurodynamical models:

Stability of Equilibrium states, Hopfield Network, Brain-state-in-a-Box network, Bidirectional associative memories. (06)

Fuzzy Logic:

Basic concepts of Fuzzy Logic, Fuzzy Vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic. (10)

Practice Task: (To be covered under theory class)

1. Design and train NN for AND or gate using perceptron
2. Design and train perceptron to classify odd and even numbers
3. Design and train NN for alphabet recognition using back propagation

4. Design and train Hopfield network for recognizing patterns such as '+' and '–'
5. Design and train NN for EXOR classification using back propagation

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Neural Network : A classroom approach	Satish Kumar	
2	Artificial Neural Networks	Jacek M.Zurada	
3	Artifical Neural Network	Simon Haykin	
4	Neural networks, Fuzzy logic and genetic algorithms	Rajasekaran & Pai	
5	Neural Network Design	Hagan, Demuth & Beale	
6	Fuzzy logic with engineering applications	T. J. Ross	

Course Code	**ECE-1302**
Course Title	**SIMULATION & MODELLING**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Modelling:
State and events, abstraction, Modelling approaches, Graphical Analogue, Scaled, Model characteristics. (08)

System Simulation:
Technique of simulation, montecarlo method, Comparison and simulation with analytical method, numerical computation techniques.

(10)

Probability Concepts in Simulation:
Stochastic variables, Discrete and continuous probability functions, Numerical evaluation, Random number generators, discrete distribution generation. (06)

SECTION-B

Arrival pattern and Service Times:
Arrival patterns: poisson, Exponential distribution, Coefficient of variations, Service times, Queuing, Solution of queuing, Solution of Queuing problems.

(04)

Discrete System Simulation:
Discrete events, Representation of time, Arrival patterns, Gathering statistics, Measuring utilization and occupancy.

(05)

Analysis of Simulation Output:
Nature of the problems, Estimation methods, Simulation run statistics, Time series analysis, Discrete and continuous random variables, Probability mass function, Distribution functions, Reliability, Discrete and continuous Markov Chains.

(10)

Statistical Interference:

Regression, correlation and analysis of variance. Simulation kernels, Strong predicted events, Event cancellation.

(05)

Practice Task (To be covered under Theory)
Simulation using package software such as IE3D, FDTD, VHDL, SDL, EDL &other Communication Software.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	System Simulation	Geoffrey Gordon	Prentice Hall of India
RECOMMENDED BOOKS			
1	Probability and statistics with Reliability, Queuing and computer Science Applications	Kishor S. Trivedi	Prentice Hall of India(EEE)
2	System Simulation with Digital Computer	Narsing Deo	Prentice Hall of India
3	Discrete Event System Simulation	Jerry Banks, John S. Carson II, Barry L. Nelson	Prentice Hall of India, 2nd Ed.

Course Code	**ECE-1303**
Course Title	**Smart System Technologies**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Outcomes(CO)	1. Analyze real life problems requiring smart systems. 2. Identify components to implement solutions.

SYLLABUS

Note for Examiner- *Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction: Main definitions for smart sensors and its properties, quasi-digital sensors, MTS, MEMS and system-on-chip (SoC); Sensors classifications from output point of view and quasi-digital sensors classification; Sensors architectures for integrated and smart sensors; Informative parameters (unified and frequency-time domain parameters of signal); Advantages of frequency as informative parameter including high noise immunity, high power of signal, wide dynamic range, high reference accuracy, simple interfacing, simple Integration and coding.

Smart and Quasi-Digital Sensors Sate-of-the-Art: Temperature sensors, pressure sensors and transducers, accelerometers, rotation speed sensors, intelligent opto (light and color) sensors, humidity sensors, mass variation chemical, gas and biosensors, magnetic sensors and others (tilt, torque, level, flow, conductivity, etc.) as well as multiparameters sensors. This lets to formulate main requirements for modern sensors systems.

Classical Frequency-to-Digital Conversion Methods: standard counting method, indirect counting method, combined method and interpolation method.

Metrological performances (quantization error and other components of conversion error, conversion time, frequency range) and measures how to reduce the quantization error. It is shown that the use of weight functions can improve metrological characteristics. Phase shift-to-digital conversion.

Advanced and Self-Adapted Conversion Methods: Ratiometric counting method, reciprocal counting method, M/T counting method, constant elapsed time (CET) method single- and double buffered methods, DMA transfer method, method of dependent count (MDC) and method with non-redundant reference frequency. Methods for duty-cycle - to - digital and phase shift-to-digital conversion.

SECTION-B

Smart Sensor Systems: One-channel, multi-channel and software level sensor interfacing. Multilayer sensor based network architecture. A case study of smart sensor system - Anti-Lock Braking System (ABS) including rotation speed sensor, conversion method and sensor interfacing.

Virtual Instruments: Definition of virtual instrument. Differentiate virtual instruments from measuring systems based on PC interfacing, standalone measuring instruments, measuring systems with GUI and microcontroller-based measuring systems with virtual measuring channel. Industrial DAQ boards. Virtual instruments examples: virtual thermometer, data logger for pressure sensors, virtual tachometer and video-graphic paperless recorder.

Sensor Buses, Protocols and Networks: Sensor buses and protocols: I2C, SPI, SMBus, Maxim/Dallas 1-Wire and 3-Wire buses, CAN Bus. MODBus (protocol), SSI (bus and protocol), Fieldbus. Comparative analyze of different sensor buses. Comparative analyze of two wireless standard ZidBee and Bluetooth.

Digital Sensors and Smart Sensors System Design: Practical realizations of different smart sensors systems and digital sensors: optical sensors systems with color-to-digital and light-to-digital converters; a DAQ system for temperature sensors; accelerometers based systems; rotation speed digital sensors and systems; digital humidity sensors and data loggers; temperature and humidity multisensors system; pressure sensors systems and digital gauges; digital magnetic sensors and systems; multiparameters sensors systems.

IEEE 1451 Standard and Frequency Sensors: Brief introduction to IEEE 1451 standard and its extension for any sensors and transducers from frequency-time signal domain. Direct Sensor-to-Microcontroller Interface for resistive, capacitance, inductance, resistive bridges sensing elements. Future Trends - The future development of main systems' components as the Universal Frequency-to-Digital Converter (UFDC-2) and Universal Sensors and Transducers Interface (USTI). Integration of all components of sensor system into a single system-on-chip (SoC) with advanced processing and conversion methods.

Project Work:

Students will work on different problems from industries and come up with some practical solutions.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Fundamentals of Instrumentation and Measurement	Placko. D, John Wiley & Sons	2007
2	Understanding the Smart Sensors; Second edition	Frank. R, Artech House	2000
3	Fundamentals of Industrial Instrumentation and Process Control	Dunn. C.W	McGraw-Hill, 2005
4	Introduction to Instrumentation, Sensors and Process Control	Dunn. C. W; Artech House	2006

Course Code	**ECE-1304**
Course Title	**PLC & SCADA**
Type of Course	**Elective**
L T P	3-0-2
Credits	3+1
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Introduction:

Fundamental Control Concepts, PLC System, CPU-Architecture, Programmers and Monitors, PLC, Input and Output Modules-Analog and Digital, power Supply of PLCs, Internal Timers, Counters, and Flags. Criteria for Selection of PLC, PLC vs. PC. Memory requirements. (07)

SCADA:

Architecture, Potential benefits of SCADA.

Introduction to SCDA software (RS VIEW-32)Project Creation, Alarming, Data Logging, Trending, Object keys, Derived Tags Event Generation, Macros, Object Linking & Embedding, Security, PLC based SCADA Systems. (15)

SECTION-B

Programming Procedures:

Different programming formats like ladder diagram, statement list, Boolean etc. Programming based on ladder diagrams using relay, timers counters sequencers, data transfer, comparison, arithmetic, logical instructions & software flags, Programming equipments like computer, hand-held programmer, on-board programming, Human machine interface, Program Scanning, Proximity Sensors and their connection to PLC, PLC as PID Controller. (19)

NETWORKING:

Networking of PLCs, Types of Networking, and Cell control by PLCs. (04)

Recommended Books:

1. Introduction to Programmable Logic Controllers by Gray Dunmig, Boston, Delmar
2. Manuals on PLCs by Siemens/Allen Bradley
3. Proggraming Logic Controllers by Hackworth and Hackworth Jt.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Introduction to Programmable Logic Controllers	Gray Dunmig, Boston, Delmar	
2	Manuals on PLCs	Siemens/Allen Bradley	
3	Proggraming Logic Controllers	Hackworth and Hackworth Jt.	

Course Code	**ECE-1305**
Course Title	**ADVANCED ANTENNA SYSTEMS**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Review of vector potentials & antenna parameters. Linear antennas viz. λ/2 & λ/4(Input impedance, far fields, radiation resistance, directivity and efficiency). Antenna array (different types, discussion on binomial & Dolph- Tschebysheff array), Super directivity (Efficiency & directivity), design considerations. (05)

Antenna Synthesis and continuous sources (Line-source, Discretization of continuous sources), Schelkunoff polynomial method, Fourier transform method, Taylor Line-source, Triangular, cosine and cosine-squared amplitude distributions, continuous aperture. (05)

Broad-band antennas (Bi-conical, Sleeve Dipole, Cylindrical dipole, rhombic antenna, helical antenna, Yagi-Uda array), Frequency Independent antenna (planar and conical spiral, log periodic). (05)

Different antenna: (Field equivalence principle) Radiation equations, Directivity, Rectangular and Circular aperture (Radiation from apertures and distribution), Horn antenna (E-plane, H-plane, Corrugated, Di-electric loaded-field & directivity calculation). (07)

SECTION-B

Micro-strip antenna, Basic characteristics, Rectangular and Circular patches, Transmission line and cavity model, Feeding techniques and recent advancement (05)

Antenna fabrication techniques (Linear, Horn & Microstrip patch), Measurements (Impedance, Gain, polarization and Radiation pattern). Matching techniques. Antenna ranges. (05)

Smart Antenna (Principle, Block diagram), Design considerations and recent development. (04)

Wave Propagation:

Modes of Propagation: Surface Wave Propagation, Sky Wave (Ionospheric) Propagation- Virtual height, Maximum usable Frequency, Skip Distance, Optimum working frequency, Space Wave (Tropospheric) Propagation- line of sight distance. (07)

Simulation Software based discussion of antenna and radar (Design and Calculation) (02)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Antenna Theory-Analysis	C.A Balanis	
2	Antenna	J.D.Karus	
3	Microstrip Antennas	I.J.Bahl P.Bhartia Artech house	
4	Antennas and Radio Wave Propagation	K D Prasad Satya Prakashan	

Course Code	**ECE-1306**
Course Title	**CRYPTOGRAPHY & NETWORK SECURITY**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Introduction:

Network and computer security issues. Security attacks, Security Services, and Security Mechanisms. Network security models. Basic concept of symmetric and asymmetric cryptography. (02)

Symmetric Key Cryptography:

Substitution and Transposition techniques. Block cipher principles. Data Encryption Standard (DES), Triple DES. Block cipher modes of operation. Stream cipher structure and RC4 algorithm. Confidentiality using symmetric key encryption. Symmetric key distribution**.** (08)

Asymmetric Key Cryptography:

Prime numbers overview. Fermat's and Euler's theorems. Principles of public key cryptosystems. RSA algorithm. Distribution of public keys. Diffie-Hellman key exchange**.** (05)

Message Authentication:

Authentication requirements and functions. Message Authentication Code. Hash functions. Hash and MAC algorithms: MD5, Secure Hash Algorithm (SHA) and HMAC. (04)

Digital Signatures and Authentication:

Digital Signatures. Authentication protocols. Digital Signature Standard. Authentication Applications: Kerberos. (04)

SECTION-B

Email Security:

Pretty Good Privacy (PGP) operation. S/MIME specifications and functionality. (04)

IP Security:

Architecture, Authentication Header, Encapsulating Payload, Security Associations, Key Management. (04)

Web Security:

Secure Socket Layer. Transport Layer Security. Secure Electronic Transaction (04)

Intrusion Defence Mechanisms:
Intrusion Detection techniques**.** (03)
Malicious Software:
Viruses and related threats. Virus countermeasures. Distributed Denial of Service Attacks. (03)
Firewalls:
Design Principles, Characteristics, Types of Firewalls, Firewall Configuration. Trusted System. (04)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Cryptography and Network Security- Principles and Practices	Stallings, Willam	4th edition. Pearson Education, PHI
2	Cryptography and Network Security	Kahate, Atul	2nd Edition, TMH
3	Computer Networks	Tanenbaum, A.S.	4th Edition, Pearson Education
4	Cryptography and Network Security	Forouzan, B.A.	

Course Code	ECE-1307
Course Title	**RESEARCH METHODOLOGY**
Type of Course	**Elective**
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Introduction to Educational Research

Concept, types – basic, applied and action, Need for educational research (3)

Reviewing Literature

Need, Sources – Primary and Secondary, Purposes of Review, Scope of Review, steps in conducting review. (3)

Identifying and Defining Research Problem

Locating, analyzing stating and evaluating problem. Generating different types of hypotheses and evaluating them. (5)

Methods of Research

Descriptive research design - survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research (5)

Sampling Techniques

Concept of population and sample' sampling techniques - simple random sampling, stratified random sampling, systematic sampling and cluster sampling, snow ball sampling, purposive sampling, quota sampling techniques. Determining size of sample. (6)

SECTION-B

Design and Development of Measuring Instruments, Tests, questionnaires, checklists, observation schedules, evaluating research instruments, selecting a standardized test. (6)

Procedure Of Data Collection

Aspects of data collection, coding data for analysis (3)

Statistical Methods of Analysis

Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve.
Inferential statistics: t-test, Chi-square tests, correlation (rank difference and product moment), ANOVA (one way), Selecting appropriate methods. (7)

Procedure for Writing a Research Proposal

Purpose, types and components of research proposal. (3)

Procedure for Writing a Research Report

Audiences and types of research reports, Format of research report and journal articles. (2)

Strategies for Evaluating, **Research** disseminating and utilizing research – An Overview (2)

Practice Tasks

- Define a research problem in polytechnic education/industry after studying problem situation and literature
- Given the purpose, objectives of research, write hypotheses
- Select research designs for the given research objectives
- Identify the measuring instruments for the given research objectives/hypotheses
- Identify the appropriate statistical methods of analysis for the given research proposal.
- Critically analyse the given research reports on various aspects such as hypothesis, design, measuring tools, statistical analysis, interpretation etc. to identify the gaps or weaknesses in the study.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Educational Research: An Introduction	Borg, W and Gall,M.	New York, Longman.2003
2	Educational Research in Classrooms and Schools ! A Manual of Materials and Methods NY	Cohen, L.	Harper and Row Publishers.2000
3	CPSC: Developing Skills in Technician Education Research Modules 1 to 11 Singapore	Colombo Plan Staff College for Technician Education	
4	Statistics in Psychology and Education, Educational Research, Bombay	Garrett, HE and Woodworth, RS.	Vakils Fetter and Simons Ltd. 2003
5	Educational Research, Ohio	Gay, LR	Charles E. Merril Publishing Company2000.
6	Wiersma William Research Methods in Education – An Introduction London	Allyn and Bacon	Inc.2000

Course Code	**ECE-1308**
Course Title	**Wireless Sensor Networks**
Type of Course	**Elective**
L T P	**4 0 0**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Computer networks**
Course Objectives (CO)	
Course Outcome	1. Design wireless sensor networks for a given application 2. Understand emerging research areas in the field of sensor networks 3. Understand MAC protocols used for different communication standards used in WSN **4.** Explore new protocols for WSN

SYLLABUS

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt any two questions from each part.

SECTION-A

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 (8 hours)

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. (7 hours)

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. (7 hours)

SECTION-B

Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing. (8 hours)

Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Operating systems and execution environments, introduction to TinyOS and nesC. (7hours)

Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring. Home Control, Building Automation ,Industrial Automation, Medical Applications - Reconfigurable Sensor Networks ,Highway Monitoring ,Military Applications ,Civil and Environmental Engineering Applications, Wildfire Instrumentation ,Habitat Monitoring, Nanoscopic Sensor Applications , Case Study: IEEE 802.15.4 (8 hours)

TEXT BOOKS			
S. No.	Title	Author(s)	Publisher
1	Wireless Sensor Network: Technology, Protocols and Application	Kazem, Sohraby, Daniel Minoli, Taieb Zanti	John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).
2	"Protocols and Architectures for Wireless Sensor Networks	Holger Karl and Andreas Willig	John Wiley & Sons, Ltd, 2005.
RECOMMENDED BOOKS			
1	A survey of routing protocols in wireless sensor networks	K. Akkaya and M. Younis,	Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349
2	"Wireless Sensor Network Designs",	Anna Ha´c,	John Wiley & Sons Ltd,

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