SRI VENKATESWARA UNIVERSITY: TIRUPATI

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course

M.Tech ELECTRONICS AND COMMUNICATION ENGINEERING

(Signal Processing)

Choice Based Credit System (CBCS)

Academic Year 2017-2018

DEPARTMENT of ECE

VISION

To be a lead department imparting quality and value embedded higher education and research emphasizing freedom of learning and practice**.**

MISSION

- Transforming students into full-fledged professionals and to become leaders in dynamic global environment.
- Augmenting knowledge and technologies in rapidly advancing fields of Electronics and Communication Engineering.
- Promoting in depth research and create Centre of excellence in thrust areas.

Programme Educational Objectives

1. To pursue advanced research in nationally reputed institutions.
2. To pursue career in Premier organizations, Public/Private Sectors in the domain of Communication Engineering.

Program Outcomes (POs)

a. Ability to apply the knowledge of science, mathematics, and engineering principles for developing problems solving attitude.

b. Ability to identify, formulate and solve engineering problems in the signal processing areas such as Developing robust and problem specific algorithms for acquisition, processing, analysis, synthesis of signals, to be applied in Signal Processing, Machine Vision and Communication Networks.

c. Ability to understand and use different software tools in the domain of signal processing. Analysis and Verification of algorithms, Functional and timing Simulation on platforms like MATLAB, code composer studio and assembly language.

d. Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

e. Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

Abstract -- M.Tech in ECE

Department of Electronics and Communication Engineering is offering two MTech programmes, one in Communication systems and second in Signal Processing. The syllabus revision was carried out in 2016 as per AICTE model curriculum. A standard academic format common for all PG programmes describing numbers of credits, weightage for lecture, laboratories work and projects have been fixed considering the scope of study. The position and sequence of study of core courses and elective courses are made to ensure sequential and integral learning. The focus on advance study in core courses through theory and laboratories work supported by study on relevant programme specific electives are incorporated. The selection of unique courses in the basket of elective is a special feature of curricula ensuring flexibility and diversity. The emphasis on understanding advanced concepts of PG course is ensured through elaborate practical work conducted through actual and virtual laboratory experiments. The concept of designing experiments and developing concept application is made part of learning process. The PG course is spread over two years in four semesters and inclusion of mini project, audit courses, open electives and dissertation are the special features of the curriculum. The contents of course are unitized to facilitate its execution. The list of suggested reading is also made part of the curriculum. The introduction of two Audit courses covering subjects of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value education, Disaster management, Sanskrit, Pedagogy, Constitution of India, Personality development through Indian culture etc. The introduction of mini projects ensures preparedness of students to undertake major projects/dissertation. The courses included under open electives are of importance in the context of special skill development and they are on Business analytics, industrial safety, operation research and cost management of engineering project. These courses shall make students capable to work in industrial environment. The dissertation/major project work of PG programme of one-year duration is given strong weightage in the curriculum. It is expected to undertake industrially relevant problem to develop an optimal solution through extensive research work. The students and faculty can design the research project in consultant with industry preferably in the region. The planning of laboratory work/ modelling/ computational work with execution schedule is suggested at the being of the programme to ensure expected outcome. This will lead to creation of patents from the result of the programme.

Scheme of Instruction & Syllabus for Choice Based Credit System
(With effect from 2016 - 2017)
M.Tech. (Signal Processing) – I Semester

M.Tech. (Signal Processing) – I Semester

Code No	Name of the course	L/T	P/S	Credits	I -Test Marks	II - Test Marks	Continuous Assessment	End Semester Examination Hrs	End Semester Examination Marks	Total Marks
ECSPT 01	Advanced Digital Communication Techniques	4	-	4	20	20	- -	3	60	100
ECSPP 01	Advanced Digital Communication Techniques Lab	-	2	1	--	--	40	3	60	100
ECSPT02	Advanced Digital Signal Processing	4	-	4	20	20	--	3	60	100
ECSPP 02	Advanced Digital Signal Processing Lab	-	2	1	--	--	40	3	60	100
ECSPT 03	Multirate Signal processing	4	-	4	20	20	-	3	60	100
ECSPT 04	Adaptive arrays	4	-	4	20	20	-	3	60	100
	Elective-I	4	-	4	20	20	-	3	60	100

	Elective-II	4	-	4	20	20	-	3	60	100
ECSPT 18	AUDIT Course	3	-		(20)	(20)			(60)	(100)
ECSPS 01	Seminar – 1	-	2	1	-	-	100	-	-	100
	Total	27	6	27						900

Postgraduate Programme

Scheme of Instruction for choice Based Credit System

(With effect from 2016 - 2017)

M.Tech. (Signal Processing) – II Semester

Code No	Name of the course	L/T	P/S	Credits	I - Test Marks	II - Test Marks	Continuous Assessment	End Semester Examination Hrs	End Semester Examination Marks	Total Marks
ECSPT 21	Image and Video Processing	4	-	4	20	20	-	3	60	100
ECSPP 21	Image and Video Processing Lab.	-	2	1	--	-	40	3	60	100
ECSPT 22	Microwave Integrated Circuits	4	-	4	20	20	-	3	60	100
ECSPP 22	Microwave Integrated Circuits Lab.	-	2	1	--	-	40	3	60	100
ECSPT 23	Radar Signal Processing	4	-	4	20	20	-	3	60	100
ECSPT 24	Adaptive Signal Processing	4	-	4	20	20	-	3	60	100
	Elective-III	4	-	4	20	20	-	3	60	100
	Open Elective	4	-	4	20	20	-	3	60	100
ECSPT 61	AUDIT Course	3	-		(20)	(20)			(60)	(100)

ECSPS 21	Seminar – 2	- 2	1	-	-	100	-	-	100
ECSPV 21	Comprehensive Viva voce	- -	2	-	-	-	-	100	100
	Total	27 6	29						1000

List of II Semester Electives

Elective-III (Any one from the following)

1. ECSPT 25 Speech Processing
2. ECSPT 26 Array Signal Processing
3. ECSPT 27 VLSI Signal Processing
4. ECSPT 28 Network Routing Algorithms
5. ECSPT 29 Multi Variable Control Theory
6. ECSPT 30 EMI & EMC
7. ECSPT 31 Expert Systems
8. ECSPT 32 Pattern Recognition
9. ECSPT 33 Neural and Fuzzy Control Systems

10. ECSPT 34 Embedded Systems

11. ECSPT 35 DSP Algorithms and Architectures

12. ECSPT 36 Wireless Communication

13.ECSPT 37 Solid State Microwave Devices

II Year: Ist and II Semesters

S.No.	Course No.	Course Title	Credits
1	ECSPJ 21	Dissertation	24
Total **Credits**			24

ECSPT 01 ADVANCED DIGITAL COMMUNICATION TECHNIQUES

(Common to ECCST 01)

Course Educational Objectives:

- To make the students familiarize with vector and signal space concepts and memory less modulation methods.
- To make the students familiarize with vector, signal space concepts and signaling along with comprehensive about the different digital modulation techniques.
- To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.
- To impart the knowledge about spread spectrum modulation, its significance and its applications.

Course Outcomes:

- Gain knowledge to map the vector concepts to signal space.
- Able to design advanced digital modulation circuits in the area of BPSK,

DPSK.

- Capacity to design M-ary systems.
- Analyze the channel coding aspects like linear block codes, cyclic codes and convolution codes.
- Understand and analyze the broad band communication systems.

UNIT- I

Characterization of Communication Signals and Systems- Signal space representations- Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals-Memory less Modulation Methods.

UNIT- II

BASE BAND DIGITAL TRANSMISSION: Digital Pam Signals, Matched Filter, Optimum Filter. Binary Phase Shift Keying (BPSK), Differential Phase shift Keying (DPSK), Differentially Encoded PSK (DEPSK), and Quadrature Phase Shift Keying.

UNIT- III

PHASE SHIFT KEYING: M-ary Phase Shift Keying, Quadrature Phase Shift Keying (QPSK),Binary Phase Shift Keying (BPSK),M-ary FSK, Minimum Shift Keying (MSK),Amplitude Shift Keying, Comparison of Digital Modulation Techniques.

UNIT- IV

ERROR CONTROL CODING: Types of Codes, Linear block codes, cyclic codes, Convolutional codes, Tree diagram, State diagram, trellis diagram, Applications.

UNIT- V

SPREAD SPECTRUM MODULATION: Pseudo-noise Sequences, Direct Sequence Spread Spectrum Modulation, Frequency HOP Spread Spectrum Modulation, Comparison of Spread Spectrum Modulation, Applications.

Reference Books:

1. Taub-Schilling and Goutam Saha, "*Principles of Communication Systems",* 3rd Edition, , TATA McGraw-Hill.
2. J.S.Chitode, *" Digital Communication" ,*Technical Publications.
3. J.G. Proakis, "*Digital Communication",* MGH 4TH edition, 1995.
4. Edward. A. Lee and David. G. Messerschmitt, *"Digital Communication",* Allied Publishers (second edition).
5. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, *"Digital Communication Techniques"*,PHI.
6. William Feller, "*An introduction to Probability Theory and its applications",* Vol 11, Wiley 2000.

Course Outcomes

COs	Description of CO's
CO1	Gain knowledge to map the vector concepts to signal space
CO2	Able to design advanced digital modulation circuits in the area of BPSK,DPSK.
CO3	Capacity to design M-ary systems.
CO4	Analyze the channel coding aspects like linear block codes, cyclic codes and convolution codes.
CO5	Understand and analyze the broad band communication systems

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	2	2	1
CO3	3	3	3	2	1
CO4	3	2	3	3	1
CO5	2	2	3	3	2

ECSPT 02: ADVANCED DIGITAL SIGNAL PROCESSING

(Common to ECCST 02)

Course Educational Objectives:

- To study stability of the digital systems.
- To understand various schemes for digital filter implementations.
- To study of different DSP algorithms for computation of DFT.
- To learn the finite word length effects in signal processing.
- To understand various application areas using Signal processing methods.

Course Outcomes:

- Gain knowledge on Digital Systems.
- Ability to design advanced FIR and IIR Digital filter algorithms.
- Capability to implement fast algorithms in the area of Digital Signal Processing.
- Ability to analyze and implement the algorithms in finite word length systems.
- Able to apply Digital Signal Processing knowledge in specific domains.

UNIT I

LTI DISCRETE-TIME SYSTEMS IN THE TRANSFORM DOMAIN: Types of Linear-Phase transfer functions, Simple digital filters, Complementary Transfer Functions, Inverse Systems, System identification, Digital Two-Pairs, Algebraic Stability Test.

UNIT II

DIGITAL FILTER STRUCTURE AND DESIGN: All pass filters, Tunable IIR Digital filter, IIR tapped Cascaded Lattice Structures, FIR Cascaded lattice Structures, Parallel All pass realization of IIR Transfer Functions, State Space Structures, Polyphase Structures, Digital Sine-Cosine generator, Computational Complexity of Digital filter Structures, Design of IIR filter using pade' approximation, Least square design methods, Design of computationally Efficient FIR Filters.

UNIT III

DSP ALGORITHMS: Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

UNIT IV

ANALYSIS OF FINITE WORD LENGTH EFFECTS: The Quantization Process and errors, Quantization of fixed-point Numbers, Analysis of Coefficient quantization effects, A/D conversion Noise Analysis, Analysis of Arithmetic Round of errors, Dynamic range scaling, Signal to Noise ratio in Low-order IIR Filters, Low sensitivity Digital filters, Reduction of Product Round off Errors using error feedback, Limit cycle in IIR Digital filters, Round of errors in FFT algorithms.

UNIT V

APPLICATIONS OF DIGITAL SIGNAL PROCESSING: Dual Tone Multi-frequency Signal Detection, Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non stationary Signals, Musical Sound Processing, Over Sampling A/D Converter, Over Sampling D/A Converter, Discrete –Time Analytic Signal generation.

Text Books:

1. Digital Signal Processing by Sanjit K Mitra, Tata MCgraw Hill Publications
2. Digital Signal Processing Principles, Algorithms,Applications By J G Proakis, D G Manolokis,PHI.
3. Discrete-Time Signal Processing by A V Oppenhiem, R W Schafer , Pearson Education Asia.

Course Outcomes

COs	Description of CO's
CO1	Gain knowledge on Digital Systems.
CO2	Ability to design advanced FIR and IIR Digital filter algorithms.
CO3	Capability to implement fast algorithms in the area of Digital Signal Processing.
CO4	Ability to analyze and implement the algorithms in finite word length systems
CO5	Able to apply Digital Signal Processing knowledge in specific domains.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	3	3	1
CO3	2	2	3	3	1
CO4	2	2	3	3	1
CO5	2	2	2	3	1

ECSPT 03: MULTIRATE SIGNAL PROCESSING

UNIT –I

FUNDAMENTALS OF MULTIRATE THEORY: The sampling theorem - sampling at subnyquist rate - Basic Formulations and schemes. Basic Multirate operations- Decimation and Interpolation - Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation.

UNIT –II

MAXIMALLY DECIMATED FILTER BANKS: Polyphase representation - Errors in the QMF bank- Perfect reconstruction (PR) QMF Bank - Design of an alias free QMF Bank.

UNIT –III

M-CHANNEL PERFECT RECONSTRUCTION FILTERS BANKS: Uniform band and non uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation- perfect reconstruction systems.

UNIT –IV

PERFECT RECONSTRUCTION (PR) FILTERS BANKS: Paraunitary PR Filter Banks- Filter Bank Properties induced by paraunitarity- Two channel FIR paraunitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property -

UNIT –V

COSINE MODULATED FILTER BANKS: Cosine Modulated pseudo QMF Bank- Alias cancellation- phase - Phase distortion- Closed form expression- Poly-phase structure- PR Systems.

Text Books:

1. P.P. Vaidyanathan. "Multirate systems and filter banks." Prentice Hall. PTR. 1993.
2. N.J. Fliege. "Multirate digital signal processing", John Wiley 1994.
3. Sanjit K. Mitra. " Digital Signal Processing: A computer based approach." McGraw Hill. 1998.
4. R.E. Crochiere. L. R. "Multirate Digital Signal Processing", Prentice Hall. Inc.1983.
5. J.G. Proakis. D.G. Manolakis. "Digital Signal Processing: Principles. Algorithms and Applications", 3rd Edn. Prentice Hall India, 1999.

ECSPT 04: ADAPTIVE ARRAYS
(Common to ECCST 08)

Course Educational Objectives:

- To adjust the radiation maximum and null positions in desired direction.
- To estimate the signal in the presence of noise.
- To maximize Signal to Noise ratio (SNR) using different types of algorithms.
- To search the signal in the presence of noise using random search algorithms.

- To have knowledge of different recursive methods in array processing.

Course Outcomes:

- Understand the basics of various adaptive array systems.
- Design and develop optimal arrays for different propagation conditions.
- Analyze the various adaptive processing algorithms.
- Understand and apply algorithms for non stationary environment.
- Understand and apply optimization algorithms based on probability.

UNIT – I

INTRODUCTION: Motivation for using adaptive arrays, principal system elements, signal environment, array element spacing considerations, array performance, narrow band and broadband signal processing considerations, adaptive array performance measure, coverage improvement factor.

UNIT – II

OPTIMUM ARRAY PROCESSING: Signal descriptions for conventional and signal aligned arrays, optimum array processing for narrowband applications, optimum array processing for broadband applications, optimum array processing for perturbed propagation conditions, polarization sensitive arrays.

UNIT- III

ADAPTIVE ALGORITHM: Gradient-Based Algorithms, Introductory concepts, The LMS Algorithms, The Howells - Applebaum Adaptive Processor, Introduction of main beam constraints, Constraint for the case of known desired signal power level, the DSD Algorithm, The Accelerated Gradient Approach (AG), Gradient Algorithm with Constraints, Simulation results, phase-only adaptive nulling using steepest descent.

UNIT – IV

RECURSIVE METHODS FOR ADAPTIVE ARRAY PROCESSING: The weighted least square error processor, updated covariance matrix inverse, Kalman Filter methods for adaptive array processing, The minimum variance processor, simulation results.

UNIT – V

RANDOM SEARCH ALGORITHMS: Linear random search, Accelerated random search, Guided accelerated random search, Generic algorithm, Comparison of Random search algorithm, problems.

Text Books:

1. Introduction to Adaptive Arrays by Robert A. Monzingo, Randy L. Haupt, Thomas W. Miller. 2nd Edition YES DEE Publications, Chennai.

2. T.S. Rappaport & J.C.Liberti, Wireless Communication, Prentice Hall (PHI),1999.

Course Outcomes

COs	Description of CO's
CO1	Understand the basics of various adaptive array systems.
CO2	Design and develop optimal arrays for different propagation conditions.
CO3	Analyze the various adaptive processing algorithms.
CO4	Understand and apply algorithms for non stationary environment
CO5	Understand and apply optimization algorithms based on probability

CO-PO Mapping

POs	POa	POb	POc	POd	POe

COs					
CO1	3	2	3	3	1
CO2	2	3	3	2	2
CO3	2	2	3	3	1
CO4	2	2	2	2	1
CO5	2	3	3	2	1

List of I Semester Electives

ELECTIVES I & II

(Any two from the following)

1. ECSPT 05 DSP System Design
2. ECSPT 06 Detection & Estimation of Signals
3. ECSPT 07 Statistical Signal Processing
4. ECSPT 08 Biomedical Signal Processing
5. ECSPT 09 Reliability Engineering in Electronics
6. ECSPT 10 Remote Sensing
7. ECSPT 11 Nano Electronics and MEMS
8. ECSPT 12 Communication Networks

9. ECSPT 13 Transform Techniques
10. ECSPT 14 Modern Radar Systems
11. ECSPT 15 Radiation Systems
12. ECSPT 16 Global Tracking and Positioning System
13. ECSPT 17 Voice Over Internet Protocols

ECSPT 05: DSP SYSTEM DESIGN
(Common to ECCST 13)

UNIT 1

INTRODUCTION TO A POPULAR DSP FROM TEXAS INSTRUMENTS: CPU Architecture - CPU Data Paths and Control - Timers - Internal Data/Program Memory - External Memory Interface - Programming - Instructions Set and Addressing Modes - Code Composer Studio - Code Generation Tools - Code Composer Studio Debug tools – Simulator.

UNIT –II

SHARC DIGITAL SIGNAL PROCESSOR: A popular DSP from Analog Devices - Sharc/ Tiger Sharc / Blackfin (one of them) - Architecture - IOP Registers - Peripherals - Synchronous Serial Port - Interrupts - Internal/External/Multiprocessor Memory Space - Multiprocessing - Host Interface - Link Ports.

UNIT –III

DIGITAL SIGNAL PROCESSING APPLICATIONS: FIR and IIR Digital Filter Design, Filter Design Programs using MATLAB - Fourier Transform: DFT, FFT programs using MATLAB - Real Time.

UNIT –IV

IMPLEMENTATION: Implementation of Real Time Digital Filters using DSP - Implementation of FFT Applications using DSP - DTMF Tone Generation and Detection

UNIT –V

CURRENT TRENDS: Current trend in Digital Signal Processor or DSP Controller- Architecture and their applications.

Text Books:

1. Digital Signal Processing Implementation using the TMS320C6000 DSP Platform, 1st Edition; By Naim Dahnoun
2. Digital Signal Processing - A Student Guide,1st Edition; by T.J. Terrel and Lik-Kwan Shark; Macmillan Press Ltd.
3. Digital Signal Processing: A System Design Approach, 1st Edition; by David J Defatta J, Lucas Joseph G & Hodkiss William S ; John Wiley
4. Digital Signal Processing and Application with C6713 and C6416 DSK, Rulf Chassaing, Worcester Polytechnic Institute, A Wiley-Interscience Publication
5. Digital Signal Processing-A Practical Guide for Engineers and Scientists by Steven K Smith, Newnes, An imprint of Elsevier Science

References:

1. DSP Applications using 'C' and the TMS320C6X DSK, 1st Edition; by Rulph Chassaing
2. Digital Signal Processing Design, 1st Edition; byAndrew Bateman, Warren Yates
3. Introduction to Digital Signal Processing, 1st Ed; by John G Proakis, Dimitris G Manolakis
4. A Simple approach to Digital Signal processing, 1st Edition; by Kreig Marven & Gillian Ewers; Wiely Interscience
5. DSP FIRST - A Multimedia Approach, 1st Edition; by JAMES H. McClellan, Ronald Schaffer and Mark A. Yoder; Prentice Hall

6. Digital Signal Processing, 1st Edition; by Oppenheim A.V and Schafer R.W; PHI

ECSPT 06: DETECTION AND ESTIMATION OF SIGNALS

(Common to ECCST 05)

UNIT-I

INTRODUCTION TO DISCRETE-TIME SIGNALS: Simple signals – Fourier Transform of a discrete-time signal – Amplitude and phase spectrum – Frequency content and sampling rates – Transfer function – Frequency response.

UNIT-II

RANDOM-DISCRETE-TIME SIGNALS: Review of probability – Random data – Generation of Pseudo-random noise – Filtered signals – Autocorrelation and power spectral density – Sampling band – Limited random signals.

UNIT-III

DETECTION OF SIGNALS IN NOISE: Minimum probability of Error Criterion – Neyman – Pearson criterion for Radar detection of constant and variable – amplitude signals – Matched filters – Optimum formulation – Detection of Random signals – Simple problems thereon with multisample cases.

UNIT-IV

ESTIMATION OF SIGNALS IN NOISE: Linear mean squared estimation – Non linear estimates – MAP and ML estimates – Maximum likelihood estimate of parameters of linear system – Simple problems theoreon.

UNIT-V

RECURSIVE LINEAR MEAN SQUARED ESTIMATION: Estimation of a signal parameter – Estimation of time-varying signals – Kalman filtering – Filtering signals in noise – Treatment restricted to two variable case only – Simple problems.

Text Books :

1. Signal processing : Discrete Spectral analysis, Detection and Estimation, Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.
2. H.L.Van Trees, Detection, Estimation and Modulation Theory, Wiley, New York, 1968.
3. Shanmugam and Breipohl, 'Detection of signals in noise and estimation', John Wiley & Sons, New York, 1985.
4.Srinath, Rajasekaran & Viswanathan, Introduction to statistical Signal processing with Applications, Prentice Hall of India, New Delhi – 110 001, 1999.

ECSPT 07: STATISTICAL SIGNAL PROCESSING

UNIT – I

SIGNAL MODELS AND CHARACTERIZATION: Types and properties of statistical models for signals and how they relate to signal processing, common second-order methods of characterizing signals.
STOCHASTIC PROCESSES: Wide sense stationary processes, orthogonal increment processes, Wiener process, and the Poisson process, Doob decomposition, KL expansion. Ergodicity, Mean square continuity, mean square derivative and mean square integral of stochastic processes.

UNIT – II

SPECTRAL ESTIMATION: Moving average (MA), autoregressive (AR), autoregressive moving average (ARMA), Various non-parametric approaches, nonparametric methods for estimation of power spectral density, autocorrelation, cross-correlation, transfer functions, and coherence from finite signal samples.

UNIT – III

PARAMETRIC SIGNAL MODELING AND ESTIMATION: A review on random processes , A review on filtering random processes, Examples, Maximum likelihood estimation, maximum a posteriori estimation, Cramer-Rao bound Pisarenko, MUSIC, ESPRIT, Higher order statistics.

UNIT – IV

OPTIMUM LINEAR FILTERS: Linear Mean square error estimation, optimum IIR filters, optimum IIR filters, Inverse filtering and deconvolution, order recursive algorithms for optimum FIR filters, Algorithms of Levinsion, Levinson-Durbin and Schiir, Triangularization and inversion of Toeplitz matrices, Wiener filtering and Kalman filtering.

UNIT – V

LEAST SQUARES ESTIMATION: Least- squares error estimation, Least- squares Signal estimation, LS computation using the Normal equations, least- squares computation using orthogonalization Techniques and singular value decomposition.

Text Books:

1. D. G. Manolakis, V. K. Ingle, S. M. Kogon, Statistical and Adaptive Signal Processing, 2000, ISBN 0-07-040051-2.
2. Monsoon H. Hayes, *Statistical Digital Signal Processing and Modeling,* New York, USA: Wiley, 1996, ISBN-0-471-59431-8.
3. A. Papoulis, Probability, Random Variables and stochastic processes, 2nd Ed., McGraw Hill, 1983.
4. Steven M. Kay, Fundamentals of Statistical Signal Processing: Estimation theory, Upper Saddle River, New Jersey, USA: Prentice-Hall, 1993.ISSBN-0-13-345711-7.
5. J. G. Proakis, C. M. Rader, F. Ling, C. L. Nikias, M. Moonen, I. K. Proudler, Algorithms for Statistical Signal Processing, 2002, ISBN 0-13-062219.

ECSPT 08: BIOMEDICAL SIGNAL PROCESSING
(Common to ECCST 15)

UNIT I

SIGNAL, SYSTEM AND SPECTRUM: Characteristics of some dynamic biomedical signals, Noises- random, structured and physiological noises. Filters- IIR and FIR filters. Spectrum – power spectral density function, cross-spectral density and coherence function, cepstrum and homomorphic filtering. Estimation of mean of finite time signals.

UNIT II

TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION: Time series analysis – linear prediction models, process order estimation, lattice representation, non-stationary process, fixed segmentation, adaptive segmentation, application in EEG, PCG signals, Time varying analysis of Heart-rate variability, model based ECG simulator. Spectral estimation – BlackmanTukey method, periodogram, and model based estimation. Application in Heart rate variability, PCGsignals.

UNIT III

ADAPTIVE FILTERING AND WAVELET DETECTION: Filtering – LMS adaptive filter, adaptive noise canceling in ECG, improved adaptive filtering in FECG, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

UNIT IV

BIOSIGNAL CLASSIFICATION AND RECOGNITION: Signal classification and recognition – Statistical signal classification, linear discriminant function, direct feature selection and ordering, Back propagation neural network based classification. Application in Normal versus Ectopic ECG beats.

UNIT V

TIME FREQUENCY AND MULTIVARIATE ANALYSIS: Time frequency representation, spectrogram, Wigner distribution, Time-scale representation, scalogram, wavelet analysis – Data reduction techniques, ECG data compression, ECG characterization, Feature extraction- Wavelet packets, Multivariate component analysis-PCA, ICA

References:

1. Arnon Cohen, Bio-Medical Signal Processing Vol I and Vol II, CRC Press Inc., Boca Rato, Florida 1999.
2. Rangaraj M. Rangayyan, 'Biomedical Signal Analysis-A case study approach', WileyInterscience/IEEEPress, 2002
3. Willis J. Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2003.
4. Emmanuel C. Ifeachor, Barrie W.Jervis, 'Digital Signal processing- A Practical Approach' Pearsoneducation Ltd., 2002
5. Raghuveer M. Rao and AjithS.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000.

ECSPT 09: RELIABILITY ENGINEERING IN ELECTRONICS
(Common to ECCST 11)

UNIT-I

INTRODUCTION: Quality and reliability, importance of reliability, reliability parameters, Methods of achieving reliability, Reliability fundamentals and bath tub curve, Reliability measures and parameters, Electronic system reliability, Hazard rate model, Probability concepts and failure time distribution.

UNIT-II

SYSTEM RELIABILITY: System reliability modeling, v-out of 'n' system, Analysis of complex reliability structures, System reliability estimation. Measure of central tendency and dispersion system reliability with constant and variable failure rates.

UNIT-III

DEVICE RELIABILITY: Accelerated life testing, Early life reliability, Long term device reliability, Electrostatic discharge, Electrical stress, Steady state hazard rate.

UNIT-IV

RELIABILITY TECHNIQUES: Reliability prediction, Cut set, Tie set, FME set, PTA, Markov, Monte Carlo Simulation, Application to electronic systems. VLSI reliability: reliability screening and modeling, electrostatic discharge damage, Metal Electro-migration phenomena, dielectric breakdown, instabilities in ICs.

UNIT-V

MAINTAINABILITY AND AVAILABILITY CONCEPTS: Guidelines for design for maintainability, MITR, BIT / BITE facility, Spares provisioning, Electronics system, packaging and interconnections. Serial and parallel reliability maintainability and availability failure mechanisms, reliability data and analysis, Reliability improvement methods.

Text Books:

1. David J. Klinger, Yoshinao Nakada and Maria A. Menendez, " AT & T Reliability Manual ",

Von Nostrand Reinhold, New York, 5th Edition, 1998.
2. Gregg K. Hobbs, " Accelerated Reliability Engineering - HALT and HASS ", John Wiley & Sons, New York, 2000.
3. Lewis, " Introduction to Reliability Engineering ", 2nd Edition, Wiley International, 1996.
4. O' Connor, P.D.T., " Practical Reliability Engineering ", Hayden Book Company, New Jersey, 1981.

ECSPT 10: REMOTE SENSING
(Common to ECCST 12)

UNIT I

REMOTE SENSING: Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body - Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) – EMR spectrum – Visible, Infra Red (IR), Near IR, Middle IR, Thermal IR and Microwave – Black Body Radiation - Planck's law – Stefan-Boltzman law.

UNIT II

EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIALS: Atmospheric characteristics – Scattering of EMR – Raleigh, Mie, Non-selective and Raman Scattering – EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows – EMR interaction with Earth Surface Materials – Radiance, Irradiance, Incident, Reflected, Absorbed and Transmitted Energy – Reflectance – Specular and Diffuse Reflection Surfaces- Spectral Signature – Spectral Signature curves – EMR interaction with water, soil and Earth Surface: Imaging spectrometry and spectral characteristics.

UNIT III

OPTICAL AND MICROWAVE REMOTE SENSING: Satellites - Classification – Based on Orbits and Purpose – Satellite Sensors - Resolution – Description of Multi Spectral Scanning – Along and Across Track Scanners – Description of Sensors in Landsat, SPOT, IRS series – Current Satellites - Radar – Speckle - Back Scattering – Side Looking Airborne Radar – Synthetic Aperture Radar – Radiometer – Geometrical characteristics ; Sonar remote sensing systems.

UNIT IV

GEOGRAPHIC INFORMATION SYSTEM: GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

UNIT V

MISCELLANEOUS TOPICS: Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering –Classification - Integration of GIS and Remote Sensing – thermal infra-red and microwave data, applications, Application of Remote Sensing and GIS – Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Resources Information Systems. Global positioning system – an introduction.

Text Books:

1. M.G. Srinivas, Remote Sensing Applications, Narosa Publishing House, 2001.
2. Jensen, J.R., Remote sensing of the environment, Prentice Hall, 2000.
3. Lillesand T.M. and Kiefer R.W., "Remote Sensing and Image Interpretation", John Wiley and Sons, Inc, New York, 1987.
4.Janza.F.J., Blue, H.M., and Johnston, J.E., "Manual of Remote Sensing Vol. I., American Society of Photogrammetry, Virginia, U.S.A, 1975.
5. Burrough P A, "Principle of GIS for land resource assessment", Oxford
6. Mischael Hord, "Remote Sensing Methods and Applications", John Wiley & Sons, New York, 1986.
7. Singal, "Remote Sening", Tata McGraw-Hill, New Delhi, 1990.

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ECSPT 11: NANO ELECTRONICS AND MEMS

(Common to ECCST 14)

UNIT-I

MICROSCOPIES AND CARBON NANO TUBES: Nano – The Beginning – Electron microscopies – Scanning probe microscopies, Optical microscopies for Nanoscience and Technology – Other kinds of Microscopies. Carbon Nanotubes : Synthesis and purification – Filling of Nanotubes Mechanism of growth – Electronic structure – Transport, Mechanical and physical properties – Applications.

UNIT-II

SELF ASSEMBLED MONO LAYERS AND GAS PHASE CLUSTERS: Mono layers on Gold – Growth process – phase Transitions – patterning mono layers – mixed mono layers – SAMS and Applications. Cluster formation – Cluster growth – Detection and analysis of gas phase clusters – Types of clusters – properties of clusters – bonding in clusters.

UNIT-III

SEMICONDUCTOR QUANTUM DOTS AND NANO PARTICLES: Synthesis of Quantum dots – Electronic structure of Nanocrystals – Correlation of properties with size –uses. Monolayer - protected metal Nanoparticles – method of preparation characterization – Functionalized Metal Nanoparticles – Applications – superlattices.Core-shell Nanoparticles – Types of systems – characterization – properties – Applications. Nanoshells – Types of Nanoshells – properties – characterization – Applications.

UNIT-IV

QUANTUM ELECTRONICS AND SET: Quantum Electronic Devices – short – channel MOS transistor – split – gate transistor – Electron-wave transistor – Electron – spin Transistor – Quantum cellular Automata – Quantum dot array performance of single – Electron Transistor – Technology – SET circuit design – wiring and drivers – logic and memory circuits SET adder as an example of a distributed circuit – Comparison between FET and SET circuit design.

UNIT-V

MICROELECTRONIC AND MECHANICAL SYSTEMS (MEMS): Different types of transistor integration – Technological process for microminiaturization – Methods and limits of microminiaturization in silicon – Technology of Micromechanics – Micromechanics for Nanoelectronics.

Text Books:

1. T.Pradeep, 'Nano : The Essentials', TMH Edition (2008)
2. K.Goser, P.Glosekotter, J.Dienstuhl, 'Nanoelectronics and Nanosystems', Springer Edition (2004).

ECSPT 12: COMMUNICATION NETWROKS
(Common to ECCST 03)

Course Educational Objectives:

- To be familiar with wireless networking concepts, contemporary issues in networking technologies, network tools
- Explain how the packets are passed around the Internet and how the traffic and errors are controlled and to describe application and application protocols
- Students have experience in designing communication protocols and are exposed to the TCP/IP protocol suite.
- To master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks, Identify security and privacy issues that relate to computer networks.

Course outcomes:

- Understand the various communication network topologies.
- Understand the Network layer concepts.
- Ability to design a communication network.
- Ability to incorporate protocols in computer communication networks.
- Ability to apply security algorithms for communication network.

UNIT – I

INTRODUCTION TO COMMUNICATION NETWORKS: Introduction to communication networks, Efficient Transport of Packet Voice Calls, Achievable throughput in an Input-Queuing Packet switch. The Importance of Quantitative Modeling in the Engineering of, Telecommunication Networks**.**

NETWORKING: Functional Elements and Current Practice, Networking as Resource Sharing. The Functional Elements, Current Practice.

UNIT – II

COMMUNICATION NETWORKS AND SERVICES: Networks and Services, Approaches to Network Design, Key Factors in Communication Network Evolution. Applications and Layered Architectures: Examples of Layering, The OSI Reference Model, Overview of TCP/IP Architecture, The Berkeley API, Application Protocols and TCP/IP Utilities.

UNIT – III

TRANSMISSION SYSTEMS AND THE TELEPHONE NETWORK: Multiplexing, SONET, Wavelength-Division Multiplexing, Circuit Switches, The Telephone Network, Signaling, Traffic and Overload Control in Telephone Networks, Cellular Telephone Networks, Satellite Cellular Networks, Peer-to-Peer Protocols and Service Models, Data Link Controls.

UNIT – IV

TCP/IP: The TCP/IP Architecture, The Internet Protocols, IPv6, User Datagram Protocol, Transmission Control Protocol, DHCP and Mobile IP, Internet Routing Protocols, Multicast Routing.

TM NETWORKS: Why ATM?, BISDN Reference Model, ATM Signaling, IP Forwarding Architectures, Integrated Services in the Internet.

UNIT – V

SECURITY PROTOCOLS: Security and Cryptographic Algorithms, Security Protocols, Cryptographic Algorithms, RSA.

MULTIMEDIA INFORMATION AND NETWORKING: Lossless Data Compression, Digital Representation of Analog Signals, Techniques for Increasing Compression. The Real-Time Transport Protocol, Session Control Protocols.

Text Books:

1. COMMUNICATION NETWORKING *An Analytical Approach,by* Anurag Kumar , D. Manjunath, and Joy Kuri.
2. Communication Networks-Fundamental Concepts and Key Architectures Alberto Leon-Garcia & Indra
3. D Bertsekas and R Gallager, 'Data Networks', Prentice Hall, 1992.
4. COMMUNICATION NETWORKS AND COMPUTER SYSTEMS Tribute to Professor Erol Gelenbe by Javier A Barria

Course Outcomes

COs	Description of CO's
CO1	Understand the various communication network topologies
CO2	Understand the Network layer concepts
CO3	Ability to design a communication network
CO4	Ability to incorporate protocols in computer communication networks.
CO5	Ability to apply security algorithms for communication network.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	2	2	2	2	1
CO2	3	2	2	2	1
CO3	3	2	3	1	1
CO4	2	3	2	3	1
CO5	2	2	3	3	2

ECSPT 13:TRANSFORM TECHNIQUES

UNIT – I

REVIEW OF TRANSFORMS: Signal spaces, concept of convergence, Hilbert spaces for energy signals, Fourier basis, FT-failure of FT-need for time-frequency analysis, spectrogram plot-phase space plot in time-frequency plane, Continuous FT, DTFT, Discrete Fourier Series and Transforms, Z-Transform, relation between CFT-DTFT, DTFT-DFS,DFS-DFT, DCT(1D&2D), Walsh, Hadamard, Haar, Slant, KLT, Hilbert Transforms – definition, properties and applications.

UNIT – II

CWT & MRA: Time-frequency limitations, tiling of time-frequency plane for STFT, Heisenberg uncertainty principle, Short time Fourier Transform (STFT) analysis, short comings of STFT, Need for wavelets- Wavelet Basis- Concept of Scale and its relation with frequebcy , Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Need for scaling Function- Multi resolution analysis, Tiling of time scale plane for CWT. Important Wavelets : Haar, Mexican Hat Meyer, Shannon, Daubechies.

UNIT – III

Multirate Systems, Filter Banks and DWT, Basics of Decimation and Interpolation in time & frequency domains, Two-channel Filter bank, Perfect Reconstruction Condition, Relation ship between Filter Banks and Wavelet basis, DWT Filter Banks For Daubechies Wavelet Function.

UNIT – IV

SPECIAL TOPICS: Wavelet Packet Transform Multidimensional Wavelets, Bi-orthogonal basis, B-splines, Lifting Scheme of Wavelet Generation, Multi Wavelets.

UNIT – V

APPLICATIONS OF TRANSFORMS: Signal Denoising, Subband Coding of Speech and Music, Signal Compression - Use of DCT, DWT, KLT, 2-D DWT, Fractal Signal Analysis.

Text Books:

1. Jaideva C Goswami, Andrew K Chan, "Fundamentals of Wavelets- Theory, Algorithms and Applications", John Wiley & Sons, Inc, Singapore, 1999.
2. Soman.K.P, Ramachandran. K.I, "Insight into Wavelets from Theory to practice ",Printice Hall India, First Edition, 2004.
3. Raghuveer M.Rao and Ajit S. Bopardikar, Wavelet Transforms-Introduction theory and applications, Pearson edu, Asia, New Delhi, 2003.

References

1. Vetterli M. Kovacevi "Wavelets and sub-band coding", c, PJI, 1995.
2. C. Sydney Burrus "Introduction to Wavelets and Wavelet Transforms", PHI, First Edition, 1997.
3. Stephen G. Mallat, "A Wavelet Tour of Signal Processing", Academic Press, Second Edition.

ECSPT 14: MODERN RADAR SYSTEMS
(Common to ECCST 07)

Course Educational Objectives:

- To provide an introduction to the basics of radar operation.
- To explore various Radar range detection techniques.
- To provide the concepts of Radar measurement and tracking techniques.
- To make the students get familiarized with advanced radar systems.
- To provide the knowledge of Radar electronic counter measures.

Course Outcomes:

- Understand the basics of RADAR configurations.
- Analyze the different RADAR detection techniques.
- Acquaint with knowledge on RADAR system measurements and error analysis.
- Gain knowledge on advanced RADAR configurations.
- Gain knowledge on Electronic counter measures.
-

UNIT- I

RADAR CONFIGURATIONS AND OPERATIONAL CONCEPTS: Basic function, frequency bands and applications, Range equation, Receiver noise, Signal to noise ratio, Search radar, Range with active jamming, radar with clutter, detection range with combined interference. Radar cross section of simple objects and complex targets, bistatic cross section.

UNIT - II

RADAR DETECTION TECHNIQUES: Coherent and non coherent detection, matched filters, different methods of integration of pulse trains, Detection of fluctuating targets- fluctuation loss, diversity gain, binary integration of fluctuating targets, cumulative integration on fluctuating targets. Sequential detection with rapid confirmation, Constant false alarm rate detection-Cell averaging, two parameter , Time averaging and non parametric.

UNIT - III

RADAR MEASUREMENT AND TRACKING TECHNIQUES: Radar measurement characteristics: sensitivity, angle measurement, conical scan, sector scan. Mono-pulse radar, range tracking, Doppler measurement. Radar error analysis.

UNIT- IV

SPECIAL RADAR CONFIGURATIONS AND THEIR APPLICATIONS: Bi-static radar, Synthetic aperture radar, HF over the horizon radar, air surveillance radar, height finder and 3D radar.

UNIT - V

RADAR ELECTRONIC COUNTERMEASURES (ECM) AND ELECTRONIC COUNTER-COUNTERMEASURES (ECCM): Noise jamming of surveillance radar, detection range in noise jamming, Electronic counter counter measures(ECCM) provisions for surveillance radar. Objective of ECM against tracking radar, prevention and delay of acquisition, denial of range and Doppler data.

Text Books:

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition)
2. David K. Barton, Modern radar systems analysis, Artech House, Inc. 1988.
3. B, Edde, Radar: Principles, Technology, Applications, Prentice Hall, 1993.
4. Hamish D. Meikle, Modern Radar Systems
5. David K. Barton, " Radar system analysis and modeling", Artech house House INC

6. **Course Outcomes**

COs	Description of CO's
CO1	Understand the basics of RADAR configurations
CO2	Analyze the different RADAR detection techniques.
CO3	Acquaint with knowledge on RADAR system measurements and error analysis.
CO4	Gain knowledge on advanced RADAR configurations
CO5	Gain knowledge on Electronic counter measures.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	2	2	1
CO3	2	3	3	3	1
CO4	2	2	2	2	1
CO5	2	2	2	2	1

ECSPT 15: RADIATION SYSTEMS
(Common to ECCST 04)

Course Educational Objectives:

- Understand Electromagnetic Theorems.
- To know about Aperture Antennas.
- To know about Microstrip Antennas.
- Understand the basic elements of Phased Arrays.
- Explore the basic concepts about Mobile Communication Antennas.

Course outcomes:

- Understand the basics of Electromagnetics for near and Far fields.
- Ability to understand and design Aperture Horn antennas.
- Ability to analyze and design Microstrip antennas.

- Ability to design phase antenna array and feeding mechanism.
- Ability to understand and implement smart antennas for communication.

UNIT- 1

ELECTROMAGNETIC THEOREMS: Duality theorem, field equivalence principle, Babinet's principle. Vector potentials $\overline{A}$ and $\overline{F}$. Electromagnetic fields for $\overline{J}$ and $\overline{M}$. Far-field radiation.

UNIT- II

APERTURE ANTENNAS: Radiation equations. Rectangular apertures –uniform and TE_{10} mode distributions. Circular apertures- uniform and TE_{11} mode distributions. E-plane and H-Plane sectoral horns. Pyramidal horn. Conical horn.

UNIT- III

MICROSTRIP ANTENNAS: Advantages and disadvantages. Different forms of patches. Methods of excitation. Field analysis methods – Transmission line method and caving method, Application to rectangular and circular patches. Input impedance, Bandwidth, and polarization.

UNIT- IV

PHASED ARRAYS: Radiation pattern of phased arrays. Beam steering. Basic components of a phased array. Types of radiators – Dipole, open-ended waveguide, waveguide slot, and Microstrip radiators. Phase shifters – Diode phase shifters and ferrite phase shifters. Feed networks – space feeds and constrained feeds.

UNIT-V

MOBILE COMMUNICATION ANTENNAS: Base station antenna requirements. X-POL antenna. Panel antenna. Beam tilting. Smart antennas - Switched beam and adaptive beam forming concepts.

Text Books:

1. Constantine A. Balanis, "Antenna theory analysis and design", John wiley & sons, Inc., New york, 2nd Edn. 2004.
2. Merrill I. Skolnik, "Introduction to Radar Systems", Tata Mc.Graw-Hill Publishing co.Limited, New Delhi, 3rd Edn. 2001.
3. Y.T.Lo, and S.W. Lee, "Antenna Handbook Theory Applications, and Design", Van Nostrand Reinhold co., New York, 1988.

Course Outcomes

COs	Description of CO's
CO1	Understand the basics of Electromagnetics for near and Far fields.
CO2	Ability to understand and design Aperture Horn antennas
CO3	Ability to analyze and design Microstrip antennas
CO4	Ability to design phase antenna array and feeding mechanism
CO5	Ability to understand and implement smart antennas for communication.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	2	3	2	2	1
CO3	2	3	2	2	1
CO4	2	3	2	2	1

	2	3	3	3	1

SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING: TIRUPATI

Department of Electronics and Communication Engineering

Postgraduate Programme

Scheme of Instruction & Syllabus for Choice Based Credit System

(With effect from 2016 - 2017)

M.Tech. (Signal Processing) – II Semester

ECSPT 21: IMAGE AND VIDEO PROCESSING

(Common to ECCST 21)

Course Educational Objectives:

- To describe and explain basic principles of digital image and video processing.
- To cover the basic analytical methods such as image enhancement, restoration, segmentation and compression techniques, motion estimation which are widely used in image and video processing.
- Give the students a taste of the applications of the theories taught in the subject.
- This will be achieved through the project and some selected lab sessions.

Course Outcomes:

- Understanding the basic principles of Imaging.
- Gain knowledge of the images in transform domains.
- Apply pre-processing algorithms on images and videos.
- Understand and develop algorithms for image segmentation, classification and interpretation.
- Develop various data reduction algorithms for images.

UNIT –I

FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS: Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.
IMAGE SEGMENTATION: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT –II

IMAGE ENHANCEMENT: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT –III

IMAGE COMPRESSION: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT –IV

BASIC STEPS OF VIDEO PROCESSING: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT –V

2-D MOTION ESTIMATION: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Ostermann and Ya–quin Zhang. 1st Ed., PH Int.

Reference Books:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International
3. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar–TMH, 2009.
4. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier
5. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier
6. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed., Elsevier

Course Outcomes

COs	Description of CO's
CO1	Understanding the basic principles of Imaging.
CO2	Gain knowledge of the images in transform domains
CO3	Apply pre-processing algorithms on images and videos
CO4	Understand and develop algorithms for image segmentation, classification and interpretation
CO5	Develop various data reduction algorithms for images.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	3	3	1
CO3	2	2	3	3	1
CO4	2	2	3	3	1
CO5	2	2	3	3	1

ECSPT 22: MICROWAVE INTEGRATED CIRCUITS

(Common to ECCST 22)

Course Educational Objectives:

- The student should gain proficiency in using s-parameters in designing passive and active microwave circuits.
- The student should be able to use microwave CAD tools and understand their limitations.
- The student should understand the function, design, and integration of the major components in a wireless transceiver: oscillator, modulator, power amplifier, antenna, low-noise amplifier, filter, and mixer.
- At least one of these components is fabricated and characterized, so the student should become familiar with basic network analyzer usage in the lab.
- The student should also be able to work in a team and to communicate the work orally and in writing.

Course Outcomes:

- Develop parametric representation of two-port microwave networks.
- Able to design matching networks for Microwave circuits.
- Ability to design of amplifiers at microwave frequencies.
- Understanding and implementation of oscillators at microwave frequencies.
- Designing circuits for frequency conversion in millimeter range.

UNIT-I

TWO PORT MICROWAVE NETWORKS: High frequency parameters, S-parameters, properties of S-parameters, Transmission matrix, signal flow graphs, signal flow graph reduction, Applications of Signal flow graphs.

UNIT-II

DESIGN OF MATCHING NETWORKS: Impedance matching, selection of matching networks, Design of matching networks using lumped elements, Design of matching networks using distributed elements – Short or open circuit stubs, stub realization using micro strip circuits, Design of single stub and Double stub-matching.

UNIT-III

AMPLIFIER DESIGN: Small signal amplifiers – DC bias circuit design, RF/MW circuit design, Design of different types of amplifiers – Narrowband amplifier. High-gain amplifier, maximum-gain amplifier, Low-noise amplifier, Minimum-noise amplifier, Broad-band amplifier, High power amplifiers-Class A,AB, B and C amplifier design.

UNIT-IV

OSCILLATOR DESIGN: Oscillator versus amplifier design, Oscillator conditions-two port NR oscillations, design of transistor oscillators, general tuning networks- fixed frequency oscillators, frequency tunable oscillators**.**

UNIT-V

MIXER DESIGN: Mixer types-Up-converters, Down-converts, Harmonic mixers, conversion loss-diode loss, mismatch loss, Harmonic loss, SSB mixers versus DSB Mixers, One-diode mixers, Two-diode mixers; Pin diodes-switch design, phase shifters and diode attenuators.

Text Books:

1. Radio frequencency and microwave electronics By, Mattew M. Radmanesh, pearson Education.
2. Foundations of microwave Engineering, RE Collins, Mcgraw Hill, 1992.
3. Computer aided Desing of microwave circuits, K.C. Gupta, Ramesh Garg & Rakesh chadha, Artech house, Inc. 1981.
4. Introduction to microwave circuits, Devices and antennas, M.L. sisodia and vijaya lakshmi, New Age Publications, 2001.

Course Outcomes

COs	Description of CO's
CO1	Develop parametric representation of two-port microwave networks
CO2	Able to design matching networks for Microwave circuits.
CO3	Ability to design of amplifiers at microwave frequencies
CO4	Understanding and implementation of oscillators at microwave frequencies.

CO5	Designing circuits for frequency conversion in millimeter range

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**2**	**2**	**1**
CO3	**2**	**2**	**3**	**3**	**1**
CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**2**	**2**

ECSPT 23: RADAR SIGNAL PROCESSING

(Common to ECCST 29)

Course Educational Objectives:

- Understanding of the components of a radar system and their relationship to overall system and measure of performance.
- Understanding the concepts of the matched filter, ambiguity functions, and other aspects of waveform and signal processor design.
- Understanding basic detection theory as applies to radar.
- Introductions are provided to the advanced topics of synthetic aperture radar and synthetic aperture imaging.

Course Outcomes:

- Know the fundamental concepts of radar signal processing and the concepts of matched filters.
- Familiarized ambiguity function and basic radar signals.
- Acquired the knowledge about various codes and MTI.
- Understand the advanced topics of synthetic aperture radar and synthetic aperture imaging.
- Analyzed various methods of detection and recognition.
-

UNIT –I

INTRODUCTION: basic radar equation, range delay, velocity delay, Doppler effect, accuracy, resolution and ambiguity .Tradeoffs and penalties in waveform design .Significance of matched filter in radar signal analysis: complex representation of band-pass signal, matched filter response to Doppler shifted signal.

UNIT- II

AMBIGUITY FUNCTION: main properties of ambiguity function, cuts through ambiguity function, periodic ambiguity functions .Basic radar signals: constant frequency pulse, linear frequency modulated pulse, Costas frequency modulated pulse, nonlinear frequency modulation.

UNIT –III

PHASE CODED PULSE: Barker code, chirp-like phase code, asymptotically perfect codes, Huffman code, and bandwidth considerations in phase-coded signals. Diverse pulse repetition interval (PRI) pulse trains: introduction to moving target indication (MTI) radar, blind speed, MTI radar performance analysis, optimal MTI weights, diversifying the PRI.

UNIT- IV

Multi carrier phase coded signal in radar signals.Bistatic radar: advantages of a bistatic configuration, bistatic RCS, bistatic range-ambiguity function, multistatic radar configuration. Synthetic aperture radar (SAR): SAR principle, k-space understanding of SAR, different compensation techniques, sparse SAR, nonlinear SAR, apodization.

UNIT- V

DETECTION AND RECOGNITION USING RADAR: detection and recognition using 1-D range profile, detection and recognition using SAR image. Space time adaptive processing (STAP): understanding STAP, uses of STAP, bistatic STAP .Civilian uses of radar: space based SAR, segmentation of SAR images from satellite.

Text Books:

1. N. Levanon, and E. Mozeson, Radar Signals, Wiley-Interscience, 2004.
2. P. Z. Peebles, Radar Principles, John Wiley, 2004.
3. M. I. Skolnik, Introduction to Radar Systems, Tata McGraw Hill, 2001.
4. D. K. Barton, Radar System Analysis and Modeling, Artech House, 2005

5. IEEE standards on radar related areas, IEEE Explorer.

Course Outcomes

COs	Description of CO's
CO1	Know the fundamental concepts of radar signal processing and the concepts of matched filters.
CO2	Familiarized ambiguity function and basic radar signals.
CO3	Acquired the knowledge about various codes and MTI.
CO4	Understand the advanced topics of synthetic aperture radar and synthetic aperture imaging.
CO5	Analyzed various methods of detection and recognition.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**2**	**2**	**1**
CO3	**2**	**2**	**3**	**2**	**1**
CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**3**	**2**

ECSPT 24: ADAPTIVE SIGNAL PROCESSING

UNIT – I

ADAPTIVE SYSTEMS: Definitions and characteristics - applications - properties-examples - adaptive linear combiner-input signal and weight vectors - performance function-gradient and minimum mean square error - introduction to filtering-smoothing and prediction - Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance linear optimum filtering-orthogonality - Wiener – Hopf equation-performance surface.

UNIT – II

THEORY OF ADAPTATION WITH STATIONARY SIGNALS: Input correlation matrix, Eigen values and eigen vectors of the i/p correlation matrix.

SEARCHING THE PERFORMANCE SURFACE: Methods & Ideas of Gradient Search methods -Gradient Searching Algorithm & its Solution, Stability & Rate of convergence, Learning curve-gradient search, Newton's method, Steepest descent method, Comparison.

GRADIENT ESTIMATION AND ITS EFFECTS ON ADAPTATION: Gradient estimation - performance penalty - variance - excess MSE and time constants – mis-adjustments, total misadjustments and other practical considerations.

UNIT - III

LMS ALGORITHM & APPLICATIONS: Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm. Applications: Noise cancellation – Cancellation of Echoes in long distance telephone circuits, Adaptive Beam forming.

UNIT – IV

ADAPTIVE FILTERS: Filters with recursions based on the steepest descent and Newton's method, criteria for the convergence, rate of convergence. LMS filter, mean and variance of LMS, the MSE of LMS and misadjusment, Convergence of LMS.RLS recursions, assumptions for RLS, convergence of RLS coefficients and MSE.

LATTICE FILTERS: Filter based on innovations, generation of forward and backward innovations, forward and reverse error recursions. Implementation of Weiner, LMS and RLS filters using lattice filters, Levinson Durbin algorithm, reverse Levinson Durbin algorithm.

UNIT – V

KALMAN FILTERING: Introduction - Recursive Mean Square Estimation Random variables, Statement of Kalman filtering problem – Filtering -Initial conditions - Variants of Kalman filtering – Extend Kalman filtering.

APPLICATIONS OF ADAPTIVE SIGNAL PROCESSING: Adaptive modeling of a multi-path communication channel, adaptive model in geophysical exploration, Inverse adaptive modeling, equalization, and deconvolution, adaptive equalization of telephone channels, adapting poles and zeros for IIR digital filter synthesis, Adaptive interference canceling: applications in Bio-signal processing

Text Books:

1. Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing", Person Education, 2005.
2. Simon Haykin, " Adaptive Filter Theory", Pearson Education, 2003.
3. Dimitris G. Manolokis, Vinay K. Ingle and Stephan M. Kogar, "Statistical and Adaptive Signal Processing", Artech House INC., 2005.

References:

1. John R. Treichler, C. Richard Johnson, Michael G. Larimore, "Theory and Design of Adaptive Filters", Prentice-Hall of India, 2002
2. S. Thomas Alexander, "Adaptive Signal Processing - Theory and Application", Springer-Verlag.
3. A Poularikas, Z M Ramadan, Taylor and Francis, Adaptive filtering primer with MATLAB.
4. Sophocles J.Orfamadis, Optimum signal processing: An introduction –2 ed., McGraw-Hill, Newyork, 1988.
5. Jones D. Adaptive Filters [Connexions Web site]. May 12, 2005. Available at: http://cnx.rice.edu/content/col10280/1.1/

List of II Semester Electives

Elective-III

(Any one from the following)

1. ECSPT 25 Speech Processing
2. ECSPT 26 Array Signal Processing
3. ECSPT 27 VLSI Signal Processing
4. ECSPT 28 Network Routing Algorithms
5. ECSPT 29 Multi Variable Control Theory
6. ECSPT 30 EMI & EMC
7. ECSPT 31 Expert Systems

8. ECSPT 32 Pattern Recognition

9. ECSPT 33 Neural and Fuzzy Control Systems

10. ECSPT 34 Embedded Systems

11. ECSPT 35 DSP Algorithms and Architectures

12. ECSPT 36 Wireless Communication

13. ECSPT 37 Solid State Microwave Devices

ECSPT 25: SPEECH PROCESSING

(Common to ECCST 34)

UNIT -I

SPEECH PRODUCTION AND ACOUSTIC PHONETICS, SPEECH PERCEPTION: Digital models for the speech signal - mechanism of speech production - acoustic theory - lossless tube models - digital models - linear prediction of speech - auto correlation - formulation of LPC equation -solution of LPC equations - Levinson Durbin algorithm - Levinson recursion - Schur algorithm – lattice formulations and solutions - PARCOR coefficients.

UNIT - II

SPECTRAL ANALYSIS OF SPEECH: Short Time Fourier analysis - filter bank design. Auditory Perception: Psychoacoustics- Frequency Analysis and Critical Bands – Masking properties of human ear. Speech analysis: time and frequency domain techniques for pitch and formant estimation, cepstral and LPC analysis: Speech coding -subband coding of speech - transform coding - channel vocoder - formant vocoder – cepstral vocoder - vector quantizer coder- Linear predictive Coder.

UNIT - III

SPEECH SYNTHESIS, ARTICULATORY, FORMANT, LPC SYNTHESIS, VOICE RESPONSE AND TEXT-TO-SPEECH SYSTEMS: Speech synthesis - pitch extraction algorithms - gold rabiner pitch trackers - autocorrelation pitch trackers - voice/unvoiced detection - homomorphic speech processing - homomorphic systems for convolution - complex cepstrums - pitch extraction using homomorphic speech processing. Sound Mixtures and Separation - CASA, ICA & Model based separation.

UNIT-IV

SPEECH TRANSFORMATIONS: Time Scale Modification - Voice Morphing. Automatic speech recognition systems - isolated word recognition - connected word recognition -large vocabulary word recognition systems - pattern classification - DTW, HMM - speaker recognition systems - speaker verification systems – speaker identification Systems.

UNIT -V

AUDIO PROCESSING: Non speech and Music Signals - Modeling -Differential transform and sub-band coding of audio signals & standards - High Quality Audio coding using Psychoacoustic models - MPEG Audio coding standard. Music Production - sequence of steps in a bowed string instrument - Frequency response measurement of the bridge of a violin. Audio Data bases and applications - Content based retrieval.

Text Books:

1. Rabiner L.R. & Schafer R.W., “Digital Processing of Speech Signals”, Prentice Hall Inc.
2. O'Shaughnessy, D. “Speech Communication, Human and Machine”. Addison-Wesley.
3. Deller, J., J. Proakis, and J. Hansen. “Discrete-Time Processing of Speech Signals.” Macmillan.
4. Ben Gold & Nelson Morgan , “ Speech and Audio Signal Processing”, John Wiley & Sons, Inc.
5. Owens F.J., “Signal Processing of Speech”, Macmillan New Electronics
6. Saito S. & Nakata K., “Fundamentals of Speech Signal Processing”, Academic Press, Inc.
7. Papamichalis P.E., “Practical Approaches to Speech Coding”, Texas Instruments, Prentice Hall
8. Rabiner L.R. & Gold, “Theory and Applications of Digital Signal Processing”, Prentice Hall of India
9. Jayant, N. S. and P. Noll. “Digital Coding of Waveforms: Principles and Applications to Speech and Video. Signal Processing Series”, Englewood Cliffs: Prentice-Hall
10. Thomas Parsons, “Voice and Speech Processing”, McGraw Hill Series
11. Chris Rowden, “Speech Processing”, McGraw-Hill International Limited
12. Moore. B, “An Introduction to Psychology of hearing” Academic Press, London, 1997.
13. E.Zwicker and L.Fastl, “Psychoacoustics-facts and models”, Springer-Verlag., 1990.

ECSPT 26: ARRAY SIGNAL PROCESSING

UNIT - I

SPATIAL SIGNALS: Array fundamentals, Array signal Model, Signals in space and time, Spatial frequency, Direction vs. frequency, Wave fields, Far field and Near field signals.

UNIT – II

SENSOR ARRAYS: Spatial sampling, Nyquist criterion, Sensor arrays, Uniform linear arrays, planar and random arrays, Array transfer (steering) vector, Array steering vector for ULA, Performance analysis, Broadband arrays.

UNIT - III

SPATIAL FREQUENCY: Aliasing in spatial frequency domain, Spatial Frequency Transform, Spatial spectrum, Spatial Domain Filtering, Beam Forming, tapped Beam forming, eigen analysis of the optimum beam former, Spatially white signal.

UNIT – IV

ADAPTIVE BEAM FORMING: Sample matrix inversion, Diagonal loading with the SMI beam former, Implementation of the SMI beam former, linearly constrained beam formers, Partially Adaptive arrays, Side lobe cancellers, angle estimation, Beam splitting algorithms, Model based methods, Space –time adaptive array processing.

UNIT – V

DIRECTION OF ARRIVAL ESTIMATION: Non parametric methods - Beam forming and Capon methods, Resolution of Beam forming method, Subspace methods - MUSIC, Minimum Norm and ESPRIT techniques, Spatial Smoothing.

Textbooks:

1. Dan E. Dugeon and Don H. Johnson. (1993). Array Signal Processing: Concepts and Techniques, Prentice Hall.
2. D. G. Manolakis, V. K. Ingle, S. M. Kogon, Statistical and Adaptive Signal Processing, 2000, ISBN 0-07-040051-2.
3. Petre Stoica and Randolph L. Moses. (2005, 1997) Spectral Analysis of Signals. Prentice Hall.
4. Bass J, McPheeters C, Finnigan J, Rodriguez E. Array Signal Processing [Connexions Web site]. February 8, 2005. Available at: http://cnx.rice.edu/content/col10255/1.3/

ECSPT 27: VLSI SIGNAL PROCESSING

UNIT – I

INTRODUCTION TO DSP: Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms, iteration bound.
PIPELINING AND PARALLEL PROCESSING: Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power Retiming: Introduction, Definitions and Properties, Solving System of Inequalities, Retiming Techniques.

UNIT – II

FOLDING: Folding Transform, Register minimization Techniques, Register minimization in folded architectures, folding of multirate systems. Unfolding: Introduction, An Algorithm for Unfolding, Properties of Unfolding, critical Path, Unfolding and Retiming, Applications of Unfolding.

UNIT – III

SYSTOLIC ARCHITECTURE DESIGN: Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, Systolic Design for Space Representations contain Delays.

UNIT – IV

FAST CONVOLUTION: Introduction, Cook-Toom Algorithm, Winogard algorithm, Iterated Convolution, Cyclic Convolution, Design of Fast Convolution algorithm by Inspection.

UNIT – V

LOW POWER DESIGN: Scaling Vs Power Consumption, Power Analysis, Power Reduction techniques, Power Estimation Approaches.
PROGRAMMABLE DSP: Evaluation of Programmable Digital Signal Processors, DSP Processors for Mobile and Wireless Communications, Processors for Multimedia Signal Processing.

Text Books:

1. Keshab K. Parhi, VLSI Signal Processing- System Design and Implementation, John Wiley & Sons, 1999.
2. Kung S. Y, H. J., T. Kailath, VLSI and Modern Signal processing, While House, 1985, Prentice Hall.

References:

1. Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall.
2. VLSI Digital Signal Processing – Medisetti V. K ,1995, IEEE Press (NY), USA

ECSPT 28: NETWORK ROUTING ALGORITHMS

(Common to ECCST 28)

UNIT-I

Routing introduction, routing protocol requirements ,protocol choices, routing in telephone network, dynamic non-hierarchical routing(DNTR), Erlang map, real time network routing(RTNR),distance vector routing, distance vector algorithm, link state routing, computing shortest path, Dijkstra's algorithm.

UNIT-II

Routing link costs, static metrics, routing dynamics, hierarchical routing, interior and exterior protocols, common routing protocols - RIP, OSPF, EGP, BGP, PNNI, routing within a broadcast LAN.

UNIT–III

Multicast routing, multicast groups, multicast in a broadcast LAN, wide area multicast, pruning, core-based trees, protocol independent multicast, routing with policy constraints, routing for mobile hosts, mobile routing in the internet.

UNIT-IV

Error control-Causes of bit errors, bit error detection and correction, causes for packet errors, packet error detection and correction, sequence numbers, sequence numbers size, loss diction, forward error correction.

UNIT-V

Flow control—Model, classification, open-loop flow control, closed loop flow control, DEC bit flow control, TCP flow control, ATM forum end-to-end rate control scheme, Mishra/Kanakia hop-by-hop scheme, Hybrid flow control.

Text Books:

1. S.Keshav, "An engineering approach to computer networking", Pearson Education
2. M.Deepankar and K.Ramaswamy , "Network routing algorithm, protocols and architechtures", Morgon Kaufmann publishers.

ECSPT 29: MULTIVARIABLE CONTROL THEORY

UNIT-I

MATHEMATICAL FUNDAMENTALS: Invariant subspaces, Similarity transformations, Quotienting and equivalence classes.

UNIT – II

CANONICAL REPRESENTATIONS AND FEEDBACK LAWS: Multivariable Observer and controller canonical representations.

UNIT – III

Multivariable pole placement problem, multivariable observer design problem.

UNIT – IV

SYSTEM DECOMPOSITION: Controllability indices and system invariants, Controllability subspaces and Observability subspaces, stabilizability and detectability, Disturbance decoupling and Output stabilization problems.

UNIT - V

BINARY SYSTEMS: Introduction to linear modular systems.

Text Books:

1. C. T. Chen, Linear System Theory and Design , 3 rd Edn., Oxford 1999.
2. O. Gasparyan, Linear and Nonlinear Multivariable Feedback Control: A Classical Approach , John Wiley and Sons, 2007.
3. W. M. Wonham, Linear Multivariable Control: A Geometric Approach , Springer, 1985.

ECSPT 30: EMI & EMC

(Common to ECCST 25)

UNIT-I

ELECTROMAGNETIC ENVIRONMENT: overview of EMI and EMC, sources of EMI – Lighting discharge, Electrostatic discharge, Electromagnetic pulse, Noise from relays and switches, Nonlinearities in circuits – Intermodulation, cross modulation, Radiation coupling and conduction coupling.

UNIT-II

RADIATED INTERFERENCE MEASUREMENTS: Anechoic chamber, Measurements using an Anechoic chamber, TEM cell, Measurements using TEM cell, Reverberating chamber, Measurements using a Reverberating chamber, Comparison of test facilities, Measurement uncertainties.

UNIT-III

CONDUCTED INTERFERENCE MEASUREMENTS: Characterization of conduction currents/voltages, common-mode and differential mode interferences, conducted EM noise on power supply lines, conducted EMI from equipments, Immunity to conducted EMI, Detectors and measurement, Power line filter design – common mode filter, Differential mode filter, combined CM and DM filter.

UNIT-IV

GROUNDING: Principle and practice of Earthing, Precautions in Earthing, Measurement of ground resistance, system grounding for EMC, Cable shield grounding. Shielding-Shielding materials, Shielding integrity at discontinuities, conductive coatings, cable shielding, shielding effectiveness measurements, Electrical bonding.

UNIT-V

EMC COMPUTER MODELING AND SIMULATION: A generalized and comprehensive assessment methodology, EMC analysis of complex systems, modeling techniques, Electromagnetic analysis and prediction codes, Numerical code exterior system modeling, Interior system modeling using numerical codes, modeling and analysis procedure, EMC standards, - IEEE standards, Standards and Test procedures.

Text Books:

1. Bernhard Keiser, " Principles of Electromagnetic Compatibility ", Artech house, 3rd Ed, 1986.
2. Henry W.Ott, " Noise Reduction Techniques in Electronic Systems ", John Wiley and Sons, 1988.
3. V.P. Kodali, " Engineering EMC Principles, Measurements and Technologies ", IEEE Press, 1996.

ECSPT 31: EXPERT SYSTEMS

(Common to ECCST 32)

UNIT-I

KNOWLEDGE REPRESENTATION AND ISSUES: Notational systems - Trees, graphs, hierarchies, propositional and predicate logics, frames, semantics networks, constraints, conceptual dependencies, database, knowledge discovery in databases (KDD).

UNIT-II

S**EARCH:** State-space representations, Depth-first, breadth-first, heuristic search, Planning and game playing, Genetic algorithms.

UNIT-III

LOGICAL REASONING AND PROBABILISTIC REASONING: Predicate, Calculus resolution, completeness, and strategies, Unification, Prolog, monotonic and non-monotonic reasoning, Probabilistic inference networks, Fuzzy inference rules, Bayesian rules. Dempster - Shafer Calculus.

UNIT-IV

LEARNING AND COMMON SENSANE REASONING: Robot actions, strips, triangle tables, case based reasoning, spatial and temporal formalisms. Knowledge acquisition, classification rules, self directed systems.

UNIT-V

NEURAL NETWORKS AND EXPERT SYSTEMS: Principles, biological analogies, Training (techniques and errors), Recognition, Expert Systems, Organization, tools, limits, examples.

Text Books:

1. Bratko.I. Prolog, 2nd Ed., Addision -Wesley, 1990.
2. Charniak .E,And McDermott .D.,"Intoduction to Artificial intelligence", Adiison-Wesley, 1987
3. Giarratano.J.,And Riley G.,"Expert Systems principles an Programming" PWS-KENT,1989

ECSPT 32: PATTERN RECOGNITION

(Common to ECCST 33)

UNIT – I

INTRODUCTION: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation

BAYESIAN DECISION THEORY: Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces

UNIT - II

NORMAL DENSITY: Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context

MAXIMUM LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT-III

UN-SUPERVISED LEARNING AND CLUSTERING: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering .

UNIT-IV

COMPONENT ANALYSIS: Principal component analysis, non-linear component analysis; Low dimensional representations and multi dimensional scaling.

FEATURE SELECTION: Feature Generation 1 (LINEAR TRANSFORMS), Feature Generation 2.

UNIT-V

DISCRETE HIDDEN MORKOV MODELS: Introduction, Discrete–time markov process, extensions to hidden Markov models, three basic problems for HMMs.
CONTINUOUS HIDDEN MARKOV MODELS: Observation densities, training and testing with continuous HMMs, types of HMMs

Text Books:

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley student edition, Second Edition.
2. Fundamentals of speech Recognition, Lawerence Rabiner, Biing – Hwang Juang Pearson education.
3. Pattern Recognition ,THIRD EDITION, by sergios theodoridis and konstantinos-koutroumbas, Academic press.

ECSPT 33: NEURAL AND FUZZY CONTROL SYSTEMS

(Common to ECCST 35)

Course Educational Objectives:

- To provide an introduction to biological neuron, construction of artificial neuron from Biological Neurons, neural network topologies and various learning rules.
- Know the Concepts of Neural networks for non-linear systems & the applications of neural networks.
- To provide an introduction to fuzzy set theory and various operations of fuzzy sets.
- To make the students to get familiarized with the design of fuzzy logic system with examples.
- To know the concepts of adaptive fuzzy controllers.

Course Outcomes:

- Understand the Biological neural systems, construction of artificial neural systems and different learning rules.
- Acquired the knowledge about neural networks for non-linear systems and explored the neural network applications.
- Independently understand the Fuzzy set theory and fuzzy set operations.
- Gained the knowledge of the components and design,of fuzzy logic system.
- Know about different adaptive fuzzy controllers.

UNIT-I

Biological Neurons and their artificial models, Models of artificial neural networks, Neural Processing, Learning and adaptation, Neural networks learning rules. Single-layer Perception networks, Multi layer feed forward networks, Single layer feedback networks: Back propagation, Learning and training, Hopfield network.

UNIT-II

Neural networks for non-linear systems, Schemes of neuro control, system identification, Forward model and inverse model, Indirect learning neural network control applications, Case studies.

UNIT-III

Fuzzy sets, Fuzzy operation, Fuzzy relations, Fuzzy relational equations, Fuzzy measure, Fuzzy functions, Approximate reasoning, Fuzzy propositions, Fuzzy quantifiers, If-then rules.

UNIT-IV

Structure of Fuzzy Logic Controller, Fuzzification models, Database, Rulebase, Inference Engine, Defuzzication modules, Fuzzy Control Applications, Case studies.

UNIT-V

Adaptive Fuzzy Controllers - Design and Performance Evolution, Membership simction tining, Self organising Controllers, Model based Controller, Stability of Fuzzy Control systems.

Text Books:

1. Jacker.M.Zurada, “Introduction to Artificial Neural Systems”. Jaico Publishing House,1999.
2. Kosko.B, “Neural Networks and Fuzzy Systems”, PHI,1994.
3. Drainkov,Hellendroon,Reinfran, “Introduction to Fuzzy Control”, Narosa Publishers.
4. John Yen and Reja Langari, “Fuzzy Logic Intelligence, Control and Information”, Pearson Education,2003.

Course Outcomes

COs	Description of CO’s
CO1	Understand the Biological neural systems, construction of artificial neural systems and different learning rules
CO2	Acquired the knowledge about neural networks for non-linear systems and explored the neural network applications.
CO3	Independently understand the Fuzzy set theory and fuzzy set operations
CO4	Gained the knowledge of the components and design, of fuzzy logic system.
CO5	Know about different adaptive fuzzy controllers.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	3	2	1
CO3	2	3	3	2	1

CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**2**	**2**	**1**

ECSPT 34: EMBEDDED SYSTEMS

(Common to ECCST 36)

UNIT-I

INTRODUCTION: Processor embedded into system, Embedded Hardware Units, Embedded Software in a system, Embedded system-on-Chip(SOC), Design process, Classification of embedded systems.

UNIT-II

8051 and Advanced Processor architecture, Memory Organization and Real- World Interfacing: 8051 architecture, Real world interfacing, Introduction to advanced architecture, Processor and memory organization, Instruction-level-parallelism, Performance matrices, Processor selection, Memory selection.

UNIT-III

DEVICES AND COMMUNICATION BUSES FOR DEVICES AND NETWORK:
I/O types and examples, serial communication devices, Parallel device prots, Wireless devices, Timer and Counting devices, Watch dog timer, real time clock.

UNIT-IV

DEVICES DRIVERS AND INTERRUPTS SERVICE MECHANISM: Programmed I/O Busy- Approach with interrupt service mechanism, ISR concept, Interrupt sources, Interrupt handling mechanism, multiple interrupts, DMA, Device driver programming.

UNIT-V

REAL-TIME- OPERATING SYSTEMS: OS Services, Process management, Timer functions, Event functions , Memory management, Real- time Operating systems, Basic design using an RTOS. Introduction to Real time Operating Systems: Windows CE, OSEK, Linux 2.6.X and RT Linux.

Text Books:

1. Raj Kamal, “Embedded Systems” (T M H), 2008.
2. Peter Marwedel, “ Embedded System Design” – Springer Verlog, 2006.

3. Jane W. S. Liu, “Real time Systems”, Pearson Education, 2000.

ECSPT 35: DSP ALGORITHMS AND ARCHITECTURES

(Common to ECCST 38)

Course Educational Objectives:

- The evolving field of ASIC design enables the customized design of DSP algorithms on dedicated chips.
- To introduce systematic approaches for mapping algorithms to VLSI architectures.
- To deal with representation of DSP algorithms, various techniques to optimize these architectures for various parameters such as computation time, hardware, space and power consumption.
- Also introduces fast DSP algorithms for efficient hardware implementation.
- To study the architecture and programming of TMS320C67XX Processors for real time applications.

Course Outcomes:

- At the end of the course student will be knowledgeable in the architecture and programming of TMS320C67X Processors for real time applications.

UNIT – I

DSP ALGORITHM DESIGN: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, fixed-point DSP design (A/D precision, coefficient quantization, round-off and scaling), A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter, filter structures (recursive, non-recursive and lattice), algorithmic simulations of DSP systems in C, behavioral modeling in HDL, System modeling and performance measures.

UNIT - II

ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT – III

EXECUTION CONTROL AND PIPELINING: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C67XX DSPs, Data Addressing modes of TMS320C67XX Processors, Memory space of TMS320C67XX Processors, Program Control, TMS320C67XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C67XX processors, Pipeline Operation of TMS320C67XX Processors.

UNIT - IV

IMPLEMENTATIONS OF BASIC DSP ALGORITHMS: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

IMPLEMENTATION OF FFT ALGORITHMS: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C67XX, Computation of the signal spectrum.

UNIT - V

INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Text Books:

1. Sen M.Kuo, Woon-Seng S. Gan, Digital Signal Processors: Architectures, Implementations and Applications, Prentice Hall 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
3. Keshab K. Parhi, VLSI Signal Processing Systems, Design and Implementation, John Wiley & Sons,1999.
4. R. Chassaing and D. Reay, Digital Signal Processing and Applications with TMS320C6713 and TMS320C6416, Wiley, 2008.

References:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2003.
2. Uwe Meyer-Baese, Digital Signal Processing with Field Programmable Gate Array, Springer- Verlag 2001
3. John G. Proakis, Dimitris Manolakis K, DSP Principles, Algorithms and Applications, Prentice Hall 1995
4. Pirsch, Architectures for Digital Signal Processing, John Wiley and Sons, 1998.
5. Parhami, Behrooz, Computer Arithmetic: Algorithms and Hardware Designs, Oxford University Press, 2000
6. Israel Koren, A. K. Peters, Natick, Computer Arithmetic Algorithms, MA, 2002
7. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, cengage Learning India Private Limited, Delhi 2012.

Course Outcomes

COs	Description of CO's
CO1	• At the end of the course student will be knowledgeable in the architecture and programming of TMS320C67X Processors for real time applications.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	2	1

ECSPT 36: WIRELESS COMMUNICATION

(Common to ECCST 24)

Course Educational Objectives:

- To enable the student to synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel.
- To provide the student with an understanding of advanced multiple access techniques.
- To provide the student with an understanding of diversity reception techniques.
- To give the student an understanding digital cellular systems (GSM, CDMAOne, GPRS, EDGE, cdma2000, W-CDMA, and LTE).

Course Outcomes:

- Understand the evolution of cellular systems.
- Design the link budget for wireless networks.
- Understanding the channels in mobile communication.
- Develop equalization algorithms to combat channel effect.
- Gain knowledge on advanced wireless networks.

UNIT-I

WIRELESS COMMUNICATIONS & SYSTEM FUNDAMENTALS: Introduction to wireless communications systems, examples, Comparisons & trends. 2nd and 3rd generation wireless networks. Cellular concepts-frequency reuse, strategies, interference & system capacity, trunking & grade of service, improving coverage &capacity in cellular systems.

Modern wireless communication systems: Blue tooth, Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

UNIT – II

MOBILE RADIO PROPAGATION: Large-Scale Path Loss. Introduction to Radio Wave Propagation. Free Space Propagation Model. Relating Power to Electric Field. The Three Basic Propagation Mechanisms. Reflection. Ground Reflection (Two-Ray) Model. Diffraction. Scattering. Practical Link Budget Design Using Path Loss Models. Outdoor Propagation Models. Indoor Propagation Models. Signal Penetration into Buildings. Ray Tracing and Site Specific Modeling.

UNIT – III

MOBILE RADIO PROPAGATION: Small-Scale Fading and Multipath. Small-Scale Multipath Propagation. Impulse Response Model of a Multipath Channel. Small-Scale Multipath Measurements. Parameters of Mobile Multipath Channels. Types of Small-Scale Fading. Rayleigh and Ricean Distributions. Statistical Models for Multipath Fading Channels. Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels.

UNIT – IV

EQUALIZATION and DIVERSITY: Fundamentals of Equalization. Training A Generic Adaptive Equalizer. Equalizers in a Communications Receiver. Survey of Equalization Techniques. Linear Equalizers. Nonlinear Equalization. Algorithms for Adaptive Equalization. Fractionally Spaced Equalizers. Diversity Techniques. RAKE Receiver, Packet Radio, Capacity of Cellular Systems.

UNIT - V

WIRELESS NETWORKING: Introduction, Differences Between Wireless and Fixed Telephone Networks. Traffic Routing in Wireless Networks. Wireless Data Services. Common Channel Signaling (CCS). Integrated Services Digital Network (ISDN). Personal Communication

Services/Networks. Protocols for Network Access. Network Databases. Universal Mobile Telecommunication System (UMTS). Global System for Mobile (GSM). CDMA Digital Cellular Standard .

Text Books:

1. Wireless Communications By Theodore Rappaport , Pearson Publications
2. Wireless communications Technology By Roy Blake , Thomson Learning Publications
3. Mobile and Personal Communication System and Services By Raj Pandya , PHI.
4. Wireless Communication and Networking – William Stallings, PHI, 2003

Course Outcomes

COs	Description of CO's
CO1	Understand the evolution of cellular systems.
CO2	Design the link budget for wireless networks.
CO3	Understanding the channels in mobile communication
CO4	Develop equalization algorithms to combat channel effect.
CO5	Gain knowledge on advanced wireless networks.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1

CO2	**3**	**3**	**2**	**2**	**1**
CO3	**3**	**3**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**3**	**2**

ECSPT 37: SOLID STATE MICROWAVE DEVICES

(Common to ECCST 26)

UNIT-I

JUNCTION DEVICES: Tunnel diodes – principle of operation and Microwave characteristics. MIS diodes - physical structure, Electronic mechanism, strong inversion, and surface space charge. Bipolar transistors – Physical structures, Principle of operation, Microwave characteristics, and power frequency limitations. HBTs – Physical structures, operational mechanism, and applications.

UNIT-II

FIELD-EFFECT DEVICES: MESFETs – Physical structure, principle of operation, small signal equivalent circuit, Ids, Fco, fmax, power gain, noise figure, power frequency limitations, and MESFET amplifiers. MOSFETS – Physical structure, Electronic mechanism modes of operation, Id. Im, and fn. HEMTS – physical structure, operational mechanism, characteristics and applications.

UNIT-III

GUNN-EFFECT DEVICES: Gunn effect. RWH theory. Modes of operation. LSA diodes. InP diodes. Cd Te diodes. Microwave generation and amplification design examples.

UNIT-IV

AVALANCHE-EFFECT DEVICES: Modes of operation. Physical structure, Principle of operation, and performance characteristics of Read diode, IMPATT diode, TRAPATT diode, and BARITT diode, Parametric amplifiers – Nonlinear reactance, Manley-Rowe relations, and applications.

UNIT-V

LASERS AND LASER MODULATORS: Transition processes. Population inversion. Resonant carting. Junction lasers. Laser modulators- EOM, MOM, and TWEOM.

Text Books:

1. Samnel Y.Liao, " Microwave Solid state Devices". Prentice-Hall Inc., New Jersey, 1985.
2. Samuel Y Liao, "Microwave Devices and Circuits", third Edn., Pearson Education (Singapore) Private Limited, Delhi, 2003.

ECSPT 16: GLOBAL TRACKING AND POSITIONING SYSTEM
(Common to ECCST 10)

UNIT-I

INTRODUCTION: Satellites, Introduction to Tracking and GPS System, Applications of Satellite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary applications (e.g. Crystal dynamics, gravity field mapping, reference frame, atmospheric occultation) Basic concepts of GPS. Space segment, Control segment, user segment, History of GPS constellation, GPS measurement characteristics, selective availability (AS), ant spoofing (AS).

UNIT-II

ORBITS AND REFERENCE SYSTEMS: Basics of Satellite orbits and reference systems-Two-body problem, orbit elements, timer system and timer transfer using GPS, coordinate systems, GPS Orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris, Tracking problems.

UNIT-III

GPS MEASUREMENTS: GPS Observable- Measurement types (C/A Code, P-code, L1 and L2 frequencies for navigation, pseudo ranges), atmospheric delays (tropospheric and ionospheric), data format (RINEX), data combination (narrow/wide lane combinations, ionosphere-free combinations, single, double, triple differences), undifferenced models, carrier phase Vs integrated Doppler, integer biases, cycle slips, clock error.

UNIT - IV

PROCESSING TECHNIQUES: Pseudo range and carrier phase processing, ambiguity removal, Least square methods for state parameter determination, relation positioning, dilution of precision.

UNIT -V

GPS APPLICATIONS: Surveying, Geophysics, Geodsey, airborne GPS, Ground-transportation. Spaceborne GPS orbit determination, attitude control, meteorological and climate research using GPS.

Text Books:

1. B.Hoffman- Wellenhof.H.Lichetenegger and J.Collins, "GPS: Theory and Practice", 4th Edition, Springer, Wein, New York,1997.
2. A.Leick, "GPS Satellite Surveying", 2nd Edition, John Willey & Sons, New York, 1995.
3.

References:

1. B.Parkinson, JSpilker. Jr. (Eds), "GPS:Theory and Applications", Vol1 & Vol II, A1AA.370 L'Enfant Promenade SW, Washington, DC20024, 1996.
2. A.Kleusberg and P.Teunisen (Eds), GPS for Geodesy, Sringer- Verlag, Berlin, 1996.
3. L.Adams, "The GPS- A Shared National Asset", Chair, National Academy Press, Washington, DC,1995.

ECSPT 17: VOICE OVER INTERNET PROTOCOLS
(Common to ECCST 16)

UNIT-I

OVERVIEW OF IP PROTOCOL SUITE: The internet protocol, the Transmission control Protocol(TCP), The User Datagram Protocol(UDP), The Real–time Transport Protocol(RTP), IP multicast, IP version 6(IP v6),Internetworking IPv4 and IPv6, The VoIP Market, VoIP Challenges.

UNIT-II

H.323 AND H.245 STANDARDS: The H.323 Architecture, Call Signaling-Call Scenarios, H.245 Control Signaling Conference Calls-The Decomposed Gateway.

UNIT-III

THE SESSION INITIATION PROTOCOL (SIP): SIP-Architecture- Overview of SIP Messaging syntax- Examples of SIP Message Sequence- Redirect Servers- Proxy Servers. The Session Description Protocol (SDP)-Usage of SDP with SIP.

UNIT- IV

QUALITY OF SERVICES (QOS): Need for QoS- End-to end QoS, Overview of QoS Solutions- The Resource reservation Protocol (RSVP) - Diffserv – The Diffserv Architecture- Multi- Protocol Label Switching (MPLS)-The MPLS Architectures- MPLS Traffic Engineering- Label Distribution Protocols and constraint- Based Routing.

UNIT-V

VOIP AND SS7: The SS7 Protocol Suit- The Message Transfer Part (MTP), ISDN User Part (ISUP) and Signaling connection control part (SCCP), SS7 Network Architecture- Signaling Points (SPs)- Single Transfer Point (STP), Service Control Point (SCP),- Message Signal Units (MSUs)- SS7 Addressing, ISUP, Performance Requirements for SS7, Sigtran –Sigtran Architecture- SCTP- M3UA Operation- M2UA Operations-M2PA Operations- Interworking SS7 and VoIP Architectures- Internetworking Soft switch and SS7-Internet working H.323 and SS7.

References:

1. Daniel Collins, Carrier Grade Voice over IP, 2nd ed., TMH.
2. MPEG-4, part 2: ISO/IEC 14496-2: coding of audio- visual objects-part2, visual, Third Edition, May 2004.

M.Tech. (Signal Processing) – II Semester

ECSPT 21: IMAGE AND VIDEO PROCESSING

(Common to ECCST 21)

Course Educational Objectives:

- To describe and explain basic principles of digital image and video processing.
- To cover the basic analytical methods such as image enhancement, restoration, segmentation and compression techniques, motion estimation which are widely used in image and video processing.
- Give the students a taste of the applications of the theories taught in the subject.
- This will be achieved through the project and some selected lab sessions.

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UNIT –I

FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS: Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.
IMAGE SEGMENTATION: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT –II

IMAGE ENHANCEMENT: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT –III

IMAGE COMPRESSION: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT –IV

BASIC STEPS OF VIDEO PROCESSING: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT –V

2-D MOTION ESTIMATION: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Ostermann and Ya–quin Zhang. 1st Ed., PH Int.

Reference Books:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International
3. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar–TMH, 2009.
4. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier
5. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier
6. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed., Elsevier

Course Outcomes

COs	Description of CO's
CO1	Understanding the basic principles of Imaging.
CO2	Gain knowledge of the images in transform domains
CO3	Apply pre-processing algorithms on images and videos
CO4	Understand and develop algorithms for image segmentation, classification and interpretation
CO5	Develop various data reduction algorithms for images.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**1**
CO3	**2**	**2**	**3**	**3**	**1**
CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**3**	**1**

ECSPT 22: MICROWAVE INTEGRATED CIRCUITS

(Common to ECCST 22)

Course Educational Objectives:

- The student should gain proficiency in using s-parameters in designing passive and active microwave circuits.
- The student should be able to use microwave CAD tools and understand their limitations.
- The student should understand the function, design, and integration of the major components in a wireless transceiver: oscillator, modulator, power amplifier, antenna, low-noise amplifier, filter, and mixer.
- At least one of these components is fabricated and characterized, so the student should become familiar with basic network analyzer usage in the lab.
- The student should also be able to work in a team and to communicate the work orally and in writing.

Course Outcomes:

- Develop parametric representation of two-port microwave networks.
- Able to design matching networks for Microwave circuits.
- Ability to design of amplifiers at microwave frequencies.
- Understanding and implementation of oscillators at microwave frequencies.
- Designing circuits for frequency conversion in millimeter range.

UNIT-I

TWO PORT MICROWAVE NETWORKS: High frequency parameters, S-parameters, properties of S-parameters, Transmission matrix, signal flow graphs, signal flow graph reduction, Applications of Signal flow graphs.

UNIT-II

DESIGN OF MATCHING NETWORKS: Impedance matching, selection of matching networks, Design of matching networks using lumped elements, Design of matching networks using distributed elements – Short or open circuit stubs, stub realization using micro strip circuits, Design of single stub and Double stub-matching.

UNIT-III

AMPLIFIER DESIGN: Small signal amplifiers – DC bias circuit design, RF/MW circuit design, Design of different types of amplifiers – Narrowband amplifier. High-gain amplifier, maximum-gain amplifier, Low-noise amplifier, Minimum-noise amplifier, Broad-band amplifier, High power amplifiers-Class A,AB, B and C amplifier design.

UNIT-IV

OSCILLATOR DESIGN: Oscillator versus amplifier design, Oscillator conditions-two port NR oscillations, design of transistor oscillators, general tuning networks- fixed frequency oscillators, frequency tunable oscillators**.**

UNIT-V

MIXER DESIGN: Mixer types-Up-converters, Down-converts, Harmonic mixers, conversion loss-diode loss, mismatch loss, Harmonic loss, SSB mixers versus DSB Mixers, One-diode mixers, Two-diode mixers; Pin diodes-switch design, phase shifters and diode attenuators.

Text Books:

5. Radio frequencency and microwave electronics By, Mattew M. Radmanesh, pearson Education.
6. Foundations of microwave Engineering, RE Collins, Mcgraw Hill, 1992.
7. Computer aided Desing of microwave circuits, K.C. Gupta, Ramesh Garg & Rakesh chadha, Artech house, Inc. 1981.
8. Introduction to microwave circuits, Devices and antennas, M.L. sisodia and vijaya lakshmi, New Age Publications, 2001.

Course Outcomes

COs	Description of CO's
CO1	Develop parametric representation of two-port microwave networks
CO2	Able to design matching networks for Microwave circuits.
CO3	Ability to design of amplifiers at microwave frequencies
CO4	Understanding and implementation of oscillators at microwave frequencies.
CO5	Designing circuits for frequency conversion in millimeter range

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1
CO2	3	3	2	2	1
CO3	2	2	3	3	1
CO4	2	2	3	3	1
CO5	2	2	3	2	2

ECSPT 23: RADAR SIGNAL PROCESSING

(Common to ECCST 29)

Course Educational Objectives:

- Understanding of the components of a radar system and their relationship to overall system and measure of performance.
- Understanding the concepts of the matched filter, ambiguity functions, and other aspects of waveform and signal processor design.
- Understanding basic detection theory as applies to radar.
- Introductions are provided to the advanced topics of synthetic aperture radar and synthetic aperture imaging.

Course Outcomes:

- Know the fundamental concepts of radar signal processing and the concepts of matched filters.
- Familiarized ambiguity function and basic radar signals.

- Acquired the knowledge about various codes and MTI.
- Understand the advanced topics of synthetic aperture radar and synthetic aperture imaging.
- Analyzed various methods of detection and recognition.
-

UNIT –I

INTRODUCTION: basic radar equation, range delay, velocity delay, Doppler effect, accuracy, resolution and ambiguity .Tradeoffs and penalties in waveform design .Significance of matched filter in radar signal analysis: complex representation of band-pass signal, matched filter response to Doppler shifted signal.

UNIT- II

AMBIGUITY FUNCTION: main properties of ambiguity function, cuts through ambiguity function, periodic ambiguity functions .Basic radar signals: constant frequency pulse, linear frequency modulated pulse, Costas frequency modulated pulse, nonlinear frequency modulation.

UNIT –III

PHASE CODED PULSE: Barker code, chirp-like phase code, asymptotically perfect codes, Huffman code, and bandwidth considerations in phase-coded signals. Diverse pulse repetition interval (PRI) pulse trains: introduction to moving target indication (MTI) radar, blind speed, MTI radar performance analysis, optimal MTI weights, diversifying the PRI.

UNIT- IV

Multi carrier phase coded signal in radar signals.Bistatic radar: advantages of a bistatic configuration, bistatic RCS, bistatic range-ambiguity function, multistatic radar configuration. Synthetic aperture radar (SAR): SAR principle, k-space understanding of SAR, different compensation techniques, sparse SAR, nonlinear SAR, apodization.

UNIT- V

DETECTION AND RECOGNITION USING RADAR: detection and recognition using 1-D range profile, detection and recognition using SAR image. Space time adaptive processing (STAP): understanding STAP, uses of STAP, bistatic STAP .Civilian uses of radar: space based SAR, segmentation of SAR images from satellite.

Text Books:

6. N. Levanon, and E. Mozeson, Radar Signals, Wiley-Interscience, 2004.
7. P. Z. Peebles, Radar Principles, John Wiley, 2004.
8. M. I. Skolnik, Introduction to Radar Systems, Tata McGraw Hill, 2001.
9. D. K. Barton, Radar System Analysis and Modeling, Artech House, 2005
10. IEEE standards on radar related areas, IEEE Explorer.

Course Outcomes

COs	Description of CO's
CO1	Know the fundamental concepts of radar signal processing and the concepts of matched filters.
CO2	Familiarized ambiguity function and basic radar signals.
CO3	Acquired the knowledge about various codes and MTI.
CO4	Understand the advanced topics of synthetic aperture radar and synthetic aperture imaging.
CO5	Analyzed various methods of detection and recognition.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**2**	**2**	**1**

CO3	**2**	**2**	**3**	**2**	**1**
CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**3**	**2**

ECSPT 24: ADAPTIVE SIGNAL PROCESSING

UNIT – I

ADAPTIVE SYSTEMS: Definitions and characteristics - applications - properties-examples - adaptive linear combiner-input signal and weight vectors - performance function-gradient and minimum mean square error - introduction to filtering-smoothing and prediction - Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance linear optimum filtering-orthogonality - Wiener – Hopf equation-performance surface.

UNIT – II

THEORY OF ADAPTATION WITH STATIONARY SIGNALS: Input correlation matrix, Eigen values and eigen vectors of the i/p correlation matrix.

SEARCHING THE PERFORMANCE SURFACE: Methods & Ideas of Gradient Search methods -Gradient Searching Algorithm & its Solution, Stability & Rate of convergence, Learning curve-gradient search, Newton's method, Steepest descent method, Comparison.

GRADIENT ESTIMATION AND ITS EFFECTS ON ADAPTATION: Gradient estimation - performance penalty - variance - excess MSE and time constants – mis-adjustments, total misadjustments and other practical considerations.

UNIT - III

LMS ALGORITHM & APPLICATIONS: Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm. Applications: Noise cancellation – Cancellation of Echoes in long distance telephone circuits, Adaptive Beam forming.

UNIT – IV

ADAPTIVE FILTERS: Filters with recursions based on the steepest descent and Newton's method, criteria for the convergence, rate of convergence. LMS filter, mean and variance of LMS, the MSE of LMS and misadjusment, Convergence of LMS.RLS recursions, assumptions for RLS, convergence of RLS coefficients and MSE.

LATTICE FILTERS: Filter based on innovations, generation of forward and backward innovations, forward and reverse error recursions. Implementation of Weiner, LMS and RLS filters using lattice filters, Levinson Durbin algorithm, reverse Levinson Durbin algorithm.

UNIT – V

KALMAN FILTERING: Introduction - Recursive Mean Square Estimation Random variables, Statement of Kalman filtering problem – Filtering -Initial conditions - Variants of Kalman filtering – Extend Kalman filtering.

APPLICATIONS OF ADAPTIVE SIGNAL PROCESSING: Adaptive modeling of a multi-path communication channel, adaptive model in geophysical exploration, Inverse adaptive modeling, equalization, and deconvolution, adaptive equalization of telephone channels, adapting poles and zeros for IIR digital filter synthesis, Adaptive interference canceling: applications in Bio-signal processing

Text Books:

4. Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing", Person Education, 2005.
5. Simon Haykin, " Adaptive Filter Theory", Pearson Education, 2003.
6. Dimitris G. Manolokis, Vinay K. Ingle and Stephan M. Kogar, "Statistical and Adaptive Signal Processing", Artech House INC., 2005.

References:

6. John R. Treichler, C. Richard Johnson, Michael G. Larimore, "Theory and Design of Adaptive Filters", Prentice-Hall of India, 2002
7. S. Thomas Alexander, "Adaptive Signal Processing - Theory and Application", Springer-Verlag.
8. A Poularikas, Z M Ramadan, Taylor and Francis, Adaptive filtering primer with MATLAB.
9. Sophocles J.Orfamadis, Optimum signal processing: An introduction –2 ed., McGraw-Hill, Newyork, 1988.
10. Jones D. Adaptive Filters [Connexions Web site]. May 12, 2005. Available at: http://cnx.rice.edu/content/col10280/1.1/

List of II Semester Electives

Elective-III

(Any one from the following)

1. ECSPT 25 Speech Processing
2. ECSPT 26 Array Signal Processing
3. ECSPT 27 VLSI Signal Processing
4. ECSPT 28 Network Routing Algorithms
5. ECSPT 29 Multi Variable Control Theory
6. ECSPT 30 EMI & EMC
7. ECSPT 31 Expert Systems

8. ECSPT 32 Pattern Recognition

9. ECSPT 33 Neural and Fuzzy Control Systems

10. ECSPT 34 Embedded Systems

11. ECSPT 35 DSP Algorithms and Architectures

12. ECSPT 36 Wireless Communication

13. ECSPT 37 Solid State Microwave Devices

ECSPT 25: SPEECH PROCESSING

(Common to ECCST 34)

UNIT -I

SPEECH PRODUCTION AND ACOUSTIC PHONETICS, SPEECH PERCEPTION: Digital models for the speech signal - mechanism of speech production - acoustic theory - lossless tube models - digital models - linear prediction of speech - auto correlation - formulation of LPC equation -solution of LPC equations - Levinson Durbin algorithm - Levinson recursion - Schur algorithm – lattice formulations and solutions - PARCOR coefficients.

UNIT - II

SPECTRAL ANALYSIS OF SPEECH: Short Time Fourier analysis - filter bank design. Auditory Perception: Psychoacoustics- Frequency Analysis and Critical Bands – Masking properties of human ear. Speech analysis: time and frequency domain techniques for pitch and formant estimation, cepstral and LPC analysis: Speech coding -subband coding of speech - transform coding - channel vocoder - formant vocoder – cepstral vocoder - vector quantizer coder- Linear predictive Coder.

UNIT - III

SPEECH SYNTHESIS, ARTICULATORY, FORMANT, LPC SYNTHESIS, VOICE RESPONSE AND TEXT-TO-SPEECH SYSTEMS: Speech synthesis - pitch extraction algorithms - gold rabiner pitch trackers - autocorrelation pitch trackers - voice/unvoiced detection - homomorphic speech processing - homomorphic systems for convolution - complex cepstrums - pitch extraction using homomorphic speech processing. Sound Mixtures and Separation - CASA, ICA & Model based separation.

UNIT-IV

SPEECH TRANSFORMATIONS: Time Scale Modification - Voice Morphing. Automatic speech recognition systems - isolated word recognition - connected word recognition -large vocabulary word recognition systems - pattern classification - DTW, HMM - speaker recognition systems - speaker verification systems – speaker identification Systems.

UNIT -V

AUDIO PROCESSING: Non speech and Music Signals - Modeling -Differential transform and sub-band coding of audio signals & standards - High Quality Audio coding using Psychoacoustic models - MPEG Audio coding standard. Music Production - sequence of steps in a bowed string instrument - Frequency response measurement of the bridge of a violin. Audio Data bases and applications - Content based retrieval.

Text Books:

14. Rabiner L.R. & Schafer R.W., “Digital Processing of Speech Signals”, Prentice Hall Inc.
15. O'Shaughnessy, D. “Speech Communication, Human and Machine”. Addison-Wesley.
16. Deller, J., J. Proakis, and J. Hansen. “Discrete-Time Processing of Speech Signals.” Macmillan.
17. Ben Gold & Nelson Morgan , “ Speech and Audio Signal Processing”, John Wiley & Sons, Inc.
18. Owens F.J., “Signal Processing of Speech”, Macmillan New Electronics
19. Saito S. & Nakata K., “Fundamentals of Speech Signal Processing”, Academic Press, Inc.
20. Papamichalis P.E., “Practical Approaches to Speech Coding”, Texas Instruments, Prentice Hall
21. Rabiner L.R. & Gold, “Theory and Applications of Digital Signal Processing”, Prentice Hall of India
22. Jayant, N. S. and P. Noll. “Digital Coding of Waveforms: Principles and Applications to Speech and Video. Signal Processing Series”, Englewood Cliffs: Prentice-Hall
23. Thomas Parsons, “Voice and Speech Processing”, McGraw Hill Series
24. Chris Rowden, “Speech Processing”, McGraw-Hill International Limited
25. Moore. B, “An Introduction to Psychology of hearing” Academic Press, London, 1997.
26. E.Zwicker and L.Fastl, “Psychoacoustics-facts and models”, Springer-Verlag., 1990.

ECSPT 26: ARRAY SIGNAL PROCESSING

UNIT - I

SPATIAL SIGNALS: Array fundamentals, Array signal Model, Signals in space and time, Spatial frequency, Direction vs. frequency, Wave fields, Far field and Near field signals.

UNIT – II

SENSOR ARRAYS: Spatial sampling, Nyquist criterion, Sensor arrays, Uniform linear arrays, planar and random arrays, Array transfer (steering) vector, Array steering vector for ULA, Performance analysis, Broadband arrays.

UNIT - III

SPATIAL FREQUENCY: Aliasing in spatial frequency domain, Spatial Frequency Transform, Spatial spectrum, Spatial Domain Filtering, Beam Forming, tapped Beam forming, eigen analysis of the optimum beam former, Spatially white signal.

UNIT – IV

ADAPTIVE BEAM FORMING: Sample matrix inversion, Diagonal loading with the SMI beam former, Implementation of the SMI beam former, linearly constrained beam formers, Partially Adaptive arrays, Side lobe cancellers, angle estimation, Beam splitting algorithms, Model based methods, Space –time adaptive array processing.

UNIT – V

DIRECTION OF ARRIVAL ESTIMATION: Non parametric methods - Beam forming and Capon methods, Resolution of Beam forming method, Subspace methods - MUSIC, Minimum Norm and ESPRIT techniques, Spatial Smoothing.

Textbooks:

5. Dan E. Dugeon and Don H. Johnson. (1993). Array Signal Processing: Concepts and Techniques, Prentice Hall.
6. D. G. Manolakis, V. K. Ingle, S. M. Kogon, Statistical and Adaptive Signal Processing, 2000, ISBN 0-07-040051-2.
7. Petre Stoica and Randolph L. Moses. (2005, 1997) Spectral Analysis of Signals. Prentice Hall.
8. Bass J, McPheeters C, Finnigan J, Rodriguez E. Array Signal Processing [Connexions Web site]. February 8, 2005. Available at: http://cnx.rice.edu/content/col10255/1.3/

ECSPT 27: VLSI SIGNAL PROCESSING

UNIT – I

INTRODUCTION TO DSP: Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms, iteration bound.
PIPELINING AND PARALLEL PROCESSING: Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power Retiming: Introduction, Definitions and Properties, Solving System of Inequalities, Retiming Techniques.

UNIT – II

FOLDING: Folding Transform, Register minimization Techniques, Register minimization in folded architectures, folding of multirate systems. Unfolding: Introduction, An Algorithm for Unfolding, Properties of Unfolding, critical Path, Unfolding and Retiming, Applications of Unfolding.

UNIT – III

SYSTOLIC ARCHITECTURE DESIGN: Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, Systolic Design for Space Representations contain Delays.

UNIT – IV

FAST CONVOLUTION: Introduction, Cook-Toom Algorithm, Winogard algorithm, Iterated Convolution, Cyclic Convolution, Design of Fast Convolution algorithm by Inspection.

UNIT – V

LOW POWER DESIGN: Scaling Vs Power Consumption, Power Analysis, Power Reduction techniques, Power Estimation Approaches.
PROGRAMMABLE DSP: Evaluation of Programmable Digital Signal Processors, DSP Processors for Mobile and Wireless Communications, Processors for Multimedia Signal Processing.

Text Books:

3. Keshab K. Parhi, VLSI Signal Processing- System Design and Implementation, John Wiley & Sons, 1999.
4. Kung S. Y, H. J., T. Kailath, VLSI and Modern Signal processing, While House, 1985, Prentice Hall.

References:

3. Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall.
4. VLSI Digital Signal Processing – Medisetti V. K ,1995, IEEE Press (NY), USA

ECSPT 28: NETWORK ROUTING ALGORITHMS

(Common to ECCST 28)

UNIT-I

Routing introduction, routing protocol requirements ,protocol choices, routing in telephone network, dynamic non-hierarchical routing(DNTR), Erlang map, real time network routing(RTNR),distance vector routing, distance vector algorithm, link state routing, computing shortest path, Dijkstra's algorithm.

UNIT-II

Routing link costs, static metrics, routing dynamics, hierarchical routing, interior and exterior protocols, common routing protocols - RIP, OSPF, EGP, BGP, PNNI, routing within a broadcast LAN.

UNIT–III

Multicast routing, multicast groups, multicast in a broadcast LAN, wide area multicast, pruning, core-based trees, protocol independent multicast, routing with policy constraints, routing for mobile hosts, mobile routing in the internet.

UNIT-IV

Error control-Causes of bit errors, bit error detection and correction, causes for packet errors, packet error detection and correction, sequence numbers, sequence numbers size, loss diction, forward error correction.

UNIT-V

Flow control—Model, classification, open-loop flow control, closed loop flow control, DEC bit flow control, TCP flow control, ATM forum end-to-end rate control scheme, Mishra/Kanakia hop-by-hop scheme, Hybrid flow control.

Text Books:

3. S.Keshav, "An engineering approach to computer networking", Pearson Education
4. M.Deepankar and K.Ramaswamy , "Network routing algorithm, protocols and architechtures", Morgon Kaufmann publishers.

ECSPT 29: MULTIVARIABLE CONTROL THEORY

UNIT-I

MATHEMATICAL FUNDAMENTALS: Invariant subspaces, Similarity transformations, Quotienting and equivalence classes.

UNIT – II

CANONICAL REPRESENTATIONS AND FEEDBACK LAWS: Multivariable Observer and controller canonical representations.

UNIT – III

Multivariable pole placement problem, multivariable observer design problem.

UNIT – IV

SYSTEM DECOMPOSITION: Controllability indices and system invariants, Controllability subspaces and Observability subspaces, stabilizability and detectability, Disturbance decoupling and Output stabilization problems.

UNIT - V

BINARY SYSTEMS: Introduction to linear modular systems.

Text Books:

4. C. T. Chen, Linear System Theory and Design , 3 rd Edn., Oxford 1999.
5. O. Gasparyan, Linear and Nonlinear Multivariable Feedback Control: A Classical Approach , John Wiley and Sons, 2007.
6. W. M. Wonham, Linear Multivariable Control: A Geometric Approach , Springer, 1985.

ECSPT 30: EMI & EMC

(Common to ECCST 25)

UNIT-I

ELECTROMAGNETIC ENVIRONMENT: overview of EMI and EMC, sources of EMI – Lighting discharge, Electrostatic discharge, Electromagnetic pulse, Noise from relays and switches, Nonlinearities in circuits – Intermodulation, cross modulation, Radiation coupling and conduction coupling.

UNIT-II

RADIATED INTERFERENCE MEASUREMENTS: Anechoic chamber, Measurements using an Anechoic chamber, TEM cell, Measurements using TEM cell, Reverberating chamber, Measurements using a Reverberating chamber, Comparison of test facilities, Measurement uncertainties.

UNIT-III

CONDUCTED INTERFERENCE MEASUREMENTS: Characterization of conduction currents/voltages, common-mode and differential mode interferences, conducted EM noise on power supply lines, conducted EMI from equipments, Immunity to conducted EMI, Detectors and measurement, Power line filter design – common mode filter, Differential mode filter, combined CM and DM filter.

UNIT-IV

GROUNDING: Principle and practice of Earthing, Precautions in Earthing, Measurement of ground resistance, system grounding for EMC, Cable shield grounding. Shielding-Shielding materials, Shielding integrity at discontinuities, conductive coatings, cable shielding, shielding effectiveness measurements, Electrical bonding.

UNIT-V

EMC COMPUTER MODELING AND SIMULATION: A generalized and comprehensive assessment methodology, EMC analysis of complex systems, modeling techniques, Electromagnetic analysis and prediction codes, Numerical code exterior system modeling, Interior system modeling using numerical codes, modeling and analysis procedure, EMC standards, - IEEE standards, Standards and Test procedures.

Text Books:

4. Bernhard Keiser, " Principles of Electromagnetic Compatibility ", Artech house, 3rd Ed, 1986.
5. Henry W.Ott, " Noise Reduction Techniques in Electronic Systems ", John Wiley and Sons, 1988.
6. V.P. Kodali, " Engineering EMC Principles, Measurements and Technologies ", IEEE Press, 1996.

ECSPT 31: EXPERT SYSTEMS

(Common to ECCST 32)

UNIT-I

KNOWLEDGE REPRESENTATION AND ISSUES: Notational systems - Trees, graphs, hierarchies, propositional and predicate logics, frames, semantics networks, constraints, conceptual dependencies, database, knowledge discovery in databases (KDD).

UNIT-II

S**EARCH:** State-space representations, Depth-first, breadth-first, heuristic search, Planning and game playing, Genetic algorithms.

UNIT-III

LOGICAL REASONING AND PROBABILISTIC REASONING: Predicate, Calculus resolution, completeness, and strategies, Unification, Prolog, monotonic and non-monotonic reasoning, Probabilistic inference networks, Fuzzy inference rules, Bayesian rules. Dempster - Shafer Calculus.

UNIT-IV

LEARNING AND COMMON SENSANE REASONING: Robot actions, strips, triangle tables, case based reasoning, spatial and temporal formalisms. Knowledge acquisition, classification rules, self directed systems.

UNIT-V

NEURAL NETWORKS AND EXPERT SYSTEMS: Principles, biological analogies, Training (techniques and errors), Recognition, Expert Systems, Organization, tools, limits, examples.

Text Books:

4. Bratko.I. Prolog, 2nd Ed., Addision -Wesley, 1990.
5. Charniak .E,And McDermott .D.,"Intoduction to Artificial intelligence", Adiison-Wesley, 1987
6. Giarratano.J.,And Riley G.,"Expert Systems principles an Programming" PWS-KENT,1989

ECSPT 32: PATTERN RECOGNITION

(Common to ECCST 33)

UNIT – I

INTRODUCTION: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation

BAYESIAN DECISION THEORY: Introduction, continuous features – two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces

UNIT - II

NORMAL DENSITY: Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context

MAXIMUM LIKELIHOOD AND BAYESIAN PARAMETER ESTIMATION: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT-III

UN-SUPERVISED LEARNING AND CLUSTERING: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering .

UNIT-IV

COMPONENT ANALYSIS: Principal component analysis, non-linear component analysis; Low dimensional representations and multi dimensional scaling.

FEATURE SELECTION: Feature Generation 1 (LINEAR TRANSFORMS), Feature Generation 2.

UNIT-V

DISCRETE HIDDEN MORKOV MODELS: Introduction, Discrete–time markov process, extensions to hidden Markov models, three basic problems for HMMs.
CONTINUOUS HIDDEN MARKOV MODELS: Observation densities, training and testing with continuous HMMs, types of HMMs

Text Books:

1. Pattern classifications, Richard O. Duda, Peter E. Hart, David G. Stroke. Wiley student edition, Second Edition.
2. Fundamentals of speech Recognition, Lawerence Rabiner, Biing – Hwang Juang Pearson education.
3. Pattern Recognition ,THIRD EDITION, by sergios theodoridis and konstantinos-koutroumbas, Academic press.

ECSPT 33: NEURAL AND FUZZY CONTROL SYSTEMS

(Common to ECCST 35)

Course Educational Objectives:

- To provide an introduction to biological neuron, construction of artificial neuron from Biological Neurons, neural network topologies and various learning rules.
- Know the Concepts of Neural networks for non-linear systems & the applications of neural networks.
- To provide an introduction to fuzzy set theory and various operations of fuzzy sets.
- To make the students to get familiarized with the design of fuzzy logic system with examples.
- To know the concepts of adaptive fuzzy controllers.

Course Outcomes:

- Understand the Biological neural systems, construction of artificial neural systems and different learning rules.
- Acquired the knowledge about neural networks for non-linear systems and explored the neural network applications.
- Independently understand the Fuzzy set theory and fuzzy set operations.
- Gained the knowledge of the components and design,of fuzzy logic system.
- Know about different adaptive fuzzy controllers.

UNIT-I

Biological Neurons and their artificial models, Models of artificial neural networks, Neural Processing, Learning and adaptation, Neural networks learning rules. Single-layer Perception networks, Multi layer feed forward networks, Single layer feedback networks: Back propagation, Learning and training, Hopfield network.

UNIT-II

Neural networks for non-linear systems, Schemes of neuro control, system identification, Forward model and inverse model, Indirect learning neural network control applications, Case studies.

UNIT-III

Fuzzy sets, Fuzzy operation, Fuzzy relations, Fuzzy relational equations, Fuzzy measure, Fuzzy functions, Approximate reasoning, Fuzzy propositions, Fuzzy quantifiers, If-then rules.

UNIT-IV

Structure of Fuzzy Logic Controller, Fuzzification models, Database, Rulebase, Inference Engine, Defuzzication modules, Fuzzy Control Applications, Case studies.

UNIT-V

Adaptive Fuzzy Controllers - Design and Performance Evolution, Membership simction tining, Self organising Controllers, Model based Controller, Stability of Fuzzy Control systems.

Text Books:

5. Jacker.M.Zurada, “Introduction to Artificial Neural Systems”. Jaico Publishing House,1999.
6. Kosko.B, “Neural Networks and Fuzzy Systems”, PHI,1994.
7. Drainkov,Hellendroon,Reinfran, “Introduction to Fuzzy Control”, Narosa Publishers.
8. John Yen and Reja Langari, “Fuzzy Logic Intelligence, Control and Information”, Pearson Education,2003.

Course Outcomes

COs	Description of CO’s
CO1	Understand the Biological neural systems, construction of artificial neural systems and different learning rules
CO2	Acquired the knowledge about neural networks for non-linear systems and explored the neural network applications.
CO3	Independently understand the Fuzzy set theory and fuzzy set operations
CO4	Gained the knowledge of the components and design, of fuzzy logic system.
CO5	Know about different adaptive fuzzy controllers.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	**3**	**2**	**2**	**2**	**1**
CO2	**3**	**3**	**3**	**2**	**1**
CO3	**2**	**3**	**3**	**2**	**1**

CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**2**	**2**	**1**

ECSPT 34: EMBEDDED SYSTEMS

(Common to ECCST 36)

UNIT-I

INTRODUCTION: Processor embedded into system, Embedded Hardware Units, Embedded Software in a system, Embedded system-on-Chip(SOC), Design process, Classification of embedded systems.

UNIT-II

8051 and Advanced Processor architecture, Memory Organization and Real- World Interfacing: 8051 architecture, Real world interfacing, Introduction to advanced architecture, Processor and memory organization, Instruction-level-parallelism, Performance matrices, Processor selection, Memory selection.

UNIT-III

DEVICES AND COMMUNICATION BUSES FOR DEVICES AND NETWORK:
I/O types and examples, serial communication devices, Parallel device prots, Wireless devices, Timer and Counting devices, Watch dog timer, real time clock.

UNIT-IV

DEVICES DRIVERS AND INTERRUPTS SERVICE MECHANISM: Programmed I/O Busy- Approach with interrupt service mechanism, ISR concept, Interrupt sources, Interrupt handling mechanism, multiple interrupts, DMA, Device driver programming.

UNIT-V

REAL-TIME- OPERATING SYSTEMS: OS Services, Process management, Timer functions, Event functions , Memory management, Real- time Operating systems, Basic design using an RTOS. Introduction to Real time Operating Systems: Windows CE, OSEK, Linux 2.6.X and RT Linux.

Text Books:

4. Raj Kamal, “Embedded Systems” (T M H), 2008.
5. Peter Marwedel, “ Embedded System Design” – Springer Verlog, 2006.

6. Jane W. S. Liu, “Real time Systems”, Pearson Education, 2000.

ECSPT 35: DSP ALGORITHMS AND ARCHITECTURES

(Common to ECCST 38)

Course Educational Objectives:

- The evolving field of ASIC design enables the customized design of DSP algorithms on dedicated chips.
- To introduce systematic approaches for mapping algorithms to VLSI architectures.
- To deal with representation of DSP algorithms, various techniques to optimize these architectures for various parameters such as computation time, hardware, space and power consumption.
- Also introduces fast DSP algorithms for efficient hardware implementation.
- To study the architecture and programming of TMS320C67XX Processors for real time applications.

Course Outcomes:

- At the end of the course student will be knowledgeable in the architecture and programming of TMS320C67X Processors for real time applications.

UNIT – I

DSP ALGORITHM DESIGN: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, fixed-point DSP design (A/D precision, coefficient quantization, round-off and scaling), A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter, filter structures (recursive, non-recursive and lattice), algorithmic simulations of DSP systems in C, behavioral modeling in HDL, System modeling and performance measures.

UNIT - II

ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT – III

EXECUTION CONTROL AND PIPELINING: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C67XX DSPs, Data Addressing modes of TMS320C67XX Processors, Memory space of TMS320C67XX Processors, Program Control, TMS320C67XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C67XX processors, Pipeline Operation of TMS320C67XX Processors.

UNIT - IV

IMPLEMENTATIONS OF BASIC DSP ALGORITHMS: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

IMPLEMENTATION OF FFT ALGORITHMS: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C67XX, Computation of the signal spectrum.

UNIT - V

INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

Text Books:

5. Sen M.Kuo, Woon-Seng S. Gan, Digital Signal Processors: Architectures, Implementations and Applications, Prentice Hall 2004.
6. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
7. Keshab K. Parhi, VLSI Signal Processing Systems, Design and Implementation, John Wiley & Sons,1999.
8. R. Chassaing and D. Reay, Digital Signal Processing and Applications with TMS320C6713 and TMS320C6416, Wiley, 2008.

References:

8. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2003.
9. Uwe Meyer-Baese, Digital Signal Processing with Field Programmable Gate Array, Springer- Verlag 2001
10. John G. Proakis, Dimitris Manolakis K, DSP Principles, Algorithms and Applications, Prentice Hall 1995
11. Pirsch, Architectures for Digital Signal Processing, John Wiley and Sons, 1998.
12. Parhami, Behrooz, Computer Arithmetic: Algorithms and Hardware Designs, Oxford University Press, 2000
13. Israel Koren, A. K. Peters, Natick, Computer Arithmetic Algorithms, MA, 2002
14. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, cengage Learning India Private Limited, Delhi 2012.

Course Outcomes

COs	Description of CO's
CO1	• At the end of the course student will be knowledgeable in the architecture and programming of TMS320C67X Processors for real time applications.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	3	3	2	1

ECSPT 36: WIRELESS COMMUNICATION

(Common to ECCST 24)

Course Educational Objectives:

- To enable the student to synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel.
- To provide the student with an understanding of advanced multiple access techniques.
- To provide the student with an understanding of diversity reception techniques.
- To give the student an understanding digital cellular systems (GSM, CDMAOne, GPRS, EDGE, cdma2000, W-CDMA, and LTE).

Course Outcomes:

- Understand the evolution of cellular systems.
- Design the link budget for wireless networks.
- Understanding the channels in mobile communication.
- Develop equalization algorithms to combat channel effect.
- Gain knowledge on advanced wireless networks.

UNIT-I

WIRELESS COMMUNICATIONS & SYSTEM FUNDAMENTALS: Introduction to wireless communications systems, examples, Comparisons & trends. 2nd and 3rd generation wireless networks. Cellular concepts-frequency reuse, strategies, interference & system capacity, trunking & grade of service, improving coverage &capacity in cellular systems.

Modern wireless communication systems: Blue tooth, Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

UNIT – II

MOBILE RADIO PROPAGATION: Large-Scale Path Loss. Introduction to Radio Wave Propagation. Free Space Propagation Model. Relating Power to Electric Field. The Three Basic Propagation Mechanisms. Reflection. Ground Reflection (Two-Ray) Model. Diffraction. Scattering. Practical Link Budget Design Using Path Loss Models. Outdoor Propagation Models. Indoor Propagation Models. Signal Penetration into Buildings. Ray Tracing and Site Specific Modeling.

UNIT – III

MOBILE RADIO PROPAGATION: Small-Scale Fading and Multipath. Small-Scale Multipath Propagation. Impulse Response Model of a Multipath Channel. Small-Scale Multipath Measurements. Parameters of Mobile Multipath Channels. Types of Small-Scale Fading. Rayleigh and Ricean Distributions. Statistical Models for Multipath Fading Channels. Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels.

UNIT – IV

EQUALIZATION and DIVERSITY: Fundamentals of Equalization. Training A Generic Adaptive Equalizer. Equalizers in a Communications Receiver. Survey of Equalization Techniques. Linear Equalizers. Nonlinear Equalization. Algorithms for Adaptive Equalization. Fractionally Spaced Equalizers. Diversity Techniques. RAKE Receiver, Packet Radio, Capacity of Cellular Systems.

UNIT - V

WIRELESS NETWORKING: Introduction, Differences Between Wireless and Fixed Telephone Networks. Traffic Routing in Wireless Networks. Wireless Data Services. Common Channel Signaling (CCS). Integrated Services Digital Network (ISDN). Personal Communication

Services/Networks. Protocols for Network Access. Network Databases. Universal Mobile Telecommunication System (UMTS). Global System for Mobile (GSM). CDMA Digital Cellular Standard .

Text Books:

5. Wireless Communications By Theodore Rappaport , Pearson Publications
6. Wireless communications Technology By Roy Blake , Thomson Learning Publications
7. Mobile and Personal Communication System and Services By Raj Pandya , PHI.
8. Wireless Communication and Networking – William Stallings, PHI, 2003

Course Outcomes

COs	Description of CO's
CO1	Understand the evolution of cellular systems.
CO2	Design the link budget for wireless networks.
CO3	Understanding the channels in mobile communication
CO4	Develop equalization algorithms to combat channel effect.
CO5	Gain knowledge on advanced wireless networks.

CO-PO Mapping

POs / COs	POa	POb	POc	POd	POe
CO1	3	2	2	2	1

CO2	**3**	**3**	**2**	**2**	**1**
CO3	**3**	**3**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**3**	**2**

ECSPT 37: SOLID STATE MICROWAVE DEVICES

(Common to ECCST 26)

UNIT-I

JUNCTION DEVICES: Tunnel diodes – principle of operation and Microwave characteristics. MIS diodes - physical structure, Electronic mechanism, strong inversion, and surface space charge. Bipolar transistors – Physical structures, Principle of operation, Microwave characteristics, and power frequency limitations. HBTs – Physical structures, operational mechanism, and applications.

UNIT-II

FIELD-EFFECT DEVICES: MESFETs – Physical structure, principle of operation, small signal equivalent circuit, Ids, Fco, fmax, power gain, noise figure, power frequency limitations, and MESFET amplifiers. MOSFETS – Physical structure, Electronic mechanism modes of operation, Id. Im, and fn. HEMTS – physical structure, operational mechanism, characteristics and applications.

UNIT-III

GUNN-EFFECT DEVICES: Gunn effect. RWH theory. Modes of operation. LSA diodes. InP diodes. Cd Te diodes. Microwave generation and amplification design examples.

UNIT-IV

AVALANCHE-EFFECT DEVICES: Modes of operation. Physical structure, Principle of operation, and performance characteristics of Read diode, IMPATT diode, TRAPATT diode, and BARITT diode, Parametric amplifiers – Nonlinear reactance, Manley-Rowe relations, and applications.

UNIT-V

LASERS AND LASER MODULATORS: Transition processes. Population inversion. Resonant carting. Junction lasers. Laser modulators- EOM, MOM, and TWEOM.

Text Books:

3. Samnel Y.Liao, " Microwave Solid state Devices". Prentice-Hall Inc., New Jersey, 1985.
4. Samuel Y Liao, "Microwave Devices and Circuits", third Edn., Pearson Education (Singapore) Private Limited, Delhi, 2003.