ACHARYA NAGARJUNA UNIVERSITY

NAGARJUNA NAGAR – 522 510
ANDHRAPRADESH, INDIA

Scheme of Instruction, Examination and detailed Syllabi

of

ELECTRONICS & COMMUNICATION ENGINEERING

In the specialization of

COMMUNICATION ENGINEERING & SIGNAL PROCESSING

2-Year M.Tech Degree Course

(Semester System)

w.e.f. 2011-2012

ACHARYA NAGARJUNA UNIVERSITY:: NAGARJUNA NAGAR
REVISED REGULATIONS FOR
TWO - YEAR M.TECH. DEGREE COURSE
(CREDIT BASED SYSTEM)

(With effect from the batch of students admitted during the academic year 2011-2012).

1. ELIGIBILITY FOR ADMISSION

1.1 The candidates, both non-sponsored and sponsored, for Admission into M.Tech programme shall have one of the following qualifications.

S.No.	Programme	Qualifications
1	Chemical Engineering	Bachelor Degree in Chemical Engineering / Chemical Technology / Biotechnology or its equivalent Degree recognized by Acharya Nagarjuna University.
2	Civil Engineering	Bachelor Degree in Civil Engineering or its equivalent Degree recognized by Acharya Nagarjuna University.
3	Computer Science and Engineering	B.Tech/B.E Computer Science and Engineering/Information Technology/M.C.A/M.Sc. Computers/M.Sc. Eletronics/M.Sc. Mathematics or its equivalent Degree recognized by Acharya Nagarjuna University.
4	Electrical and Electronics Engineering	Bachelor Degree in Electrical & Electronics Engineering/Electrical Engineering/ Electrical Power Engineering/ AMIE (Electrical Engineering) or its equivalent Degree recognized by Acharya Nagarjuna University.
5	Electronics and Communication Engineering	Bachelor Degree in Electronics & Communication/ Electronic & Instrumentation Engineering/AMIE or its equivalent Degree recognized by Acharya Nagarjuna University.
6	Mechanical Engineering	Bachelor Degree in Mechanical Engineering or its equivalent Degree recognized by Acharya Nagarjuna University.

1.2 Admission of Non-sponsored category students: Admission of non-sponsored category students is made on the basis of GATE/PGECET rank. When GATE/PGECET qualified candidates are not available, admission will be on the basis of merit in the qualifying examination. Students with or without GATE/PGECET rank should have obtained a minimum of 50% marks in the qualifying examination to become eligible for admission.

Reservation of seats to the candidates belonging to Scheduled Castes and Scheduled Tribes is as prescribed by the State Govt./University from time to time. If suitable candidates are not available to fill all the seats reserved for S.T category, they shall be filled by students S.C. Category and vice-versa.
If suitable candidates are not available for reserved seats, they shall be filled by the general category candidates.

1.3 Admission of Sponsored Category students: Sponsored category students should have at least 50% marks in the qualifying examination to become eligible for admission to the Post Graduate Programme. Preference will be given to those candidates who are GATE/PGECET qualified.

The candidates must have a minimum of two years of full time work experience in a registered firm / company/ industry / educational and research institutions / any government department or government autonomous organizations in the relevant field in which the admission is being sought.

A letter from the employer must be furnished stating that the candidate is being sponsored to get admission. The employer should also indicate that the candidate will not be withdrawn midway till the completion of course. The rule of reservation shall not apply to the admission of sponsored category students.

1.4 The total number of full time candidates admitted into a course with or without GATE/PGECET rank should not exceed the sanctioned strength.

2.0 MEADIUM OF INSTRUCTION, DURATION AND STRUCTURE

2.1. The medium of instruction shall be in English.

2.2. The minimum and maximum period for completion of the P.G. Programme is 4 Semesters and 8 Semesters respectively for full time students.

2.3. Each Semester shall normally spread over sixteen weeks.

(a) The Programme may consist of

i. Core Courses
ii. Elective Courses
iii. Seminars
iv. Project Work

(b) The structure of the Programme comprises of two semesters of course work consisting of 6 Core subjects + 6 Elective subjects plus (3 Labs + 1 Seminar) or (2 Labs + 2 Seminar) followed by two semesters of Project work. In the third semester the student should give a project seminar. At the end of fourth semester the students should submit Project Thesis.

2.4. Project work shall be carried out under the Supervision of a Faculty Member in the concerned department.

2.5. A candidate may, however, in certain cases, be permitted to work on his Project/Dissertation at the place of employment, any recognized Institution/R&D Organization/Industry with the approval of the Head of the Department concerned and Head of the Organization. In such cases, the Project Work shall be jointly supervised by a member of the faculty and a person from the Organization holding a minimum of P.G. Degree in the concerned area of specialization.

2.6. Five copies of the Project Report certified by the Supervisor(s) and the Head of the Department concerned shall be submitted within one Calendar Year after completion of the second semester.

2.7. The student is eligible for the submission of M.Tech. Project Report at the end of fourth semester if he/she passed all the course work in the first & second semesters.

2.8. In a special case, if any candidate unable submit his/her Project Report at the end of fourth semester due to ill health or any other reason permitted by the head of the institution, he/she will be allowed submit at a latter date.and the viva-voce examination will be conducted separately.

3.0. **ATTENDANCE**

3.1 The candidate shall put up a minimum of 75% attendance in each subject.

3.2. Condonation of shortage in attendance up to 10% in any subject may be condoned by the University on the recommendations of the Principal of the concerned College for reasons of ill health and the application is submitted at the time of actual illness and is supported by a certificate from the authorized Medical Officer approved by the Principal.

3.3. If the candidate does not satisfy the attendance requirement in any subject he or she shall not be permitted to appear for the University examination in that subject and has to repeat that subject when next offered or study any other specified subject as may be required. In case of repetition the new internal marks be taken into account.

3.4. Failure in securing minimum prescribed attendance in any subject of previous Semester (s) is no bar for enrollment to the next semester.

4.0. **EVALUATION**

4.1 The performance of the candidate in each semester shall be evaluated subject wise. The maximum marks for each subject, seminar etc, will be as prescribed in the curriculum. The Internal Evaluation for Theory subjects shall be based on the best of the performances in the two mid term examinations one held in the middle of the semester and another held immediately after the completion of the instruction. The internal evaluation for practical subjects is based on the day to day performance and semester end internal practical Examination.

4.2 The marks for Seminar will be awarded by internal evaluation made by two staff members of the faculty of the department concerned.

4.3 For taking the University examination in any theory or practical subject, candidates shall be required to obtain a minimum of 50% marks in Internal evaluation in that subject failing which he/she shall be required to repeat the course in that subject when next offered or study any other specified subject as may be required. In case of repetition the new internal marks will be taken into account.

4.4 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he or she secures a minimum of 50% marks in internal evaluation.

4.5 In case the candidate does not secure the minimum academic requirement in any subject he/she has to reappear in the University examination in that subject or any equivalent subject prescribed

4.6 Failure to attain the minimum academic requirement in any subject of previous semester (s) is no bar for enrollment to the next semester.

4.7 The performance of the students in each semester shall be evaluated subject wise The distribution of marks between sessional work (based on internal assessment) and University Examination will be as follows:

Nature of the subject	Sessional Marks	University Exam. Marks
Theory subjects	30	70
Practicals	30	70
Seminar	100	--
Project work	50	150 (Viva voce)

5. AWARD OF CREDITS

Credits are awarded for each Theory/Practical/Seminar/Project Subjects. Each theory subject is awarded 4 credits and each practical/Seminar subjects is awarded 2 credits. Project seminar in III Semester is awarded 8 credits and Project Viva-voce at the end of IV Semester is awarded 16 credits.

6. AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	≥85%	S	10.0
2	75%-84%	A	9.0
3	65%-74%	B	8.0
4	60%-64%	C	7.0
5	55%-59%	D	6.0
6	50%-54%	E	5.0
7	≤49%	F(Fail)	0.0
8	The grade 'W' represents withdrawal/absent (subsequently changed into pass or E to S or F grade in the same semester)	W	0.0

A Student securing 'F' grade in any subject there by securing 0 grade points has to reappear and secure at least 'E' grade at the subsequent examinations in that subject

'W' denotes withdrawal/absent for a subject

- After results are declared and Grade sheets will be issued to each student which will contain the following details:
- The list of subjects in the semester and corresponding credits and Grade obtained
- The Grade point average(GPA) for the semester and
- The Cumulative Grade Point Average(CGPA) of all subjects put together up to that semester from first semester onwards

GPA is calculated based on the fallowing formula:

$$\frac{\text{Sum of [No. Credits X Grade Points]}}{\text{Sum of Credits}}$$

CGPA will be calculated in a similar manner, considering all the subjects enrolled from first semester onwards.

7. AWARD OF DEGREE AND CLASS

A candidate who becomes eligible for the award of the degree shall be placed in the following three divisions based on the CGPA secured by him/her for the entire Programme

S.No.	Class	CGPA
1	First Class With Distinction	8.0 or more
2	First Class	6.5 or more but less than 8.0
3	Second Class	5.0 or more but less than 6.5

8. WITH-HOLDING OF RESULTS

The result of a candidate may be withheld in the following cases

i. The candidate has not paid dues to the institution
ii. A case of indiscipline is pending against the candidate
iii. A case of malpractice in examination is pending against the candidate

The issue of degree is liable to be withheld in such cases

9. GENERAL

9.1 The University reserves the right of altering the regulations as and when necessary.

9.2 The regulations altered will be applicable to all the candidates on the rolls irrespective of the fact that the regulations at the time of admission of the student to the programme are different.

9.3 The Academic Regulations should be read as a whole for purpose of any Interpretation Whenever there is a dispute regarding interpretation of regulations, the decision of the Vice-Chancellor is final.

I Semester

Sl. No.	COURSE DETAILS		Scheme of Instruction		Scheme of Examination				Credits
	Code No.	Subject Name	Periods per week		Duration of University Exam(hrs)	Maximum Marks		Total Marks	
			Lecture+ Tutorial	Practical		Sessional Marks	University Marks		
1	CESP 511	Advanced Digital Communication	4	-	3	30	70	100	4
2	CESP 512	Coding Theory And Techniques	4	-	3	30	70	100	4
3	CESP 513	Speech Signal Processing	4	-	3	30	70	100	4
4	CESP 514	**ELECTIVE-I:** 1. Image & Video Processing 2. Wavelet Signal Processing 3. Radar Signal Processing	4	-	3	30	70	100	4
5	CESP 515	**ELECTIVE-I** 1. Spread Spectrum Communication 2. Advanced signal processing 3. Fibre Optic Communication	4	--	3	30	70	100	4
6	CESP 516	**ELECTIVE-III:** 1. Artificial Neural Networks 2. Adaptive Signal Processing 3. Microwave Measurements	4	-	3	30	70	100	4
7	CESP 551	Communication Lab	-	3	3	30	70	100	2
8	CESP 552	Seminar	-	3	-	100	-	100	2
TOTAL			**24**	**6**		**310**	**490**	**800**	**28**

II Semester

Sl. No	COURSE DETAILS		Scheme of Instruction		Scheme of Examination				Credits
	Code No.	Subject Name	Periods per week		Maximum Marks			Total Marks	
			Lecture+ Tutorial	Practical	Duration of University Exam (hrs)	Sessional Marks	University Marks		
1	CESP 521	Real Time Signal Processing	4	-	3	30	70	100	4
2	CESP 522	Multirate Systems and Filter Banks	4	-	3	30	70	100	4
3	CESP 523	Wireless Communication	4	-	3	30	70	100	4
4	CESP 524	**ELECTIVE-I** 1. Embedded Systems 2. Pattern Recognition 3. Random processing &Information Theory	4	-	3	30	70	100	4
5	CESP 525	**ELECTIVE –II** 1.Satellite Communication Systems 2. Global Positioning Systems 3. Telecommunication Switching Systems	4	-	3	30	70	100	4
6	CESP 526	**ELECTIVE-III** 1. Fuzzy Techniques 2. Optimization Techniques 3. Orthogonal Frequency Division Multiplexing	4	-	3	30	70	100	4
7	CESP 561	Signal Processing Lab	-	3	3	30	70	100	2
8	CESP 562	Seminar	-	3	-	100	-	100	2
TOTAL			**24**	**6**	**-**	**310**	**490**	**800**	**28**

III SEMESTER

Sl. No	COURSE DETAILS		Scheme of Instruction		Scheme of Examination				Credits
	Code No.	Subject Name	Periods per week		Maximum Marks			Total Marks	
			Lecture+ Tutorial	Practical	Duration of University Exam (hrs)	Sessional Marks	University Marks		
1	CESP 651	Project Seminar	-	-	-	100	-	100	8

IV SEMESTER

Sl. No	COURSE DETAILS		Scheme of Instruction		Scheme of Examination				Credits
	Code No.	Subject Name	Periods per week		Maximum Marks			Total Marks	
			Lecture+ Tutorial	Practical	Duration of University Exam (hrs)	Sessional Marks	University Marks		
1	CESP 661	Project	-	-	-	50	150	200	16

CESP 511
ADVANCED DIGITAL COMMUNICATION

UNIT I

Intersymbol interference, Duo-binary signaling and modified duo-binary signaling, linear predictive coding, review of orthogonal signals, coherent BPSK & BFSK, MSK, Noncoherent modulator techniques, M-ary modulation of PSK, FSK and QAM

UNIT II

PN sequences, A Notion of spread spectrum, Direct – Sequence spread coherent BPSK, signal – space dimensionality and processing gain, probability of error, frequency – hop spread spectrum, synchronization of spread spectrum signals : Acquisition and tracking

UNIT III

Encryption and Decryption: A model of the encryption and decryption process. Cipher systems, stream encryption and Public key encrypto system.

UNIT IV

Fading: Characterization of fading multi-path channels, Diversity Techniques for fading multi-path channels, frequency selective, non-selective fading, Signal time spreading, Time variance of the channel caused by motion.

Text Books:

1. Simon Haykin – Digital Communications
2. B.Sklar, Digital Communications, Addison Wesley.

Reference Books:

1. J.G. Proakis, Digital Communications, McGraw Hill.
2. Taub and Schiling – Principles of Communication Systems 2nd edition

CESP 512
CODING THEORY AND TECHNIQUES

UNIT – I

Source Coding : Mathematical models of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, coding for Discrete memoryless Sources, Properties of Codes, Iluffman Code, Run Length Codes, Lempel-Ziv Codes, Shanon – Fano coding

UNIT – II

Channel Coding : Introduction to Linear Block Codes, Generated Matrix, Systematic Linear Block Codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome Testing, Error Detecting and Correcting Capability of Linear Block Codes, Hamming Codes, Probability of an Undetected Error for Linear Codes Over a BSC- Perfect Codes

UNIT – III

Cycle Codes : Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties, Encoding in Systematic Form, Syndrome Computation and Error Detection, Decoding of Cyclic Codes, Cyclic Hamming Codes
BCH Codes: Description of the Codes, Minimum Distance and BCH Bounds, Decoding Procedure for BCH Codes, Implementation of Galors Field Arithmetic, Implementation of Error Correction

UNIT-IV

Convolutional Codes: Encoding of Convolutional Codes, Structural Properties of Convolutional Codes, State Diagram, Tree Diagram, Trellis Diagram, Maximum, Likelihood Decoding of Convolutional Codes, Viterbi Algorithm, Sequential decoding algorithm

Text Books :

1. Error Control Coding – Fundamentals and Applications by SHU LIN and Daniel J. Costello, JR., Prentice Hall Inc
2. Simon Haykin – Communication Systems, 4th edition
3. Digital Communications – Fundamentals and Applications by Bernard Sklar, Pearson Education Asis, 2003
4. Digital Communications – John G. Proakis, Mc. Graw Hill Publications
5. J. Das, Sk. Mallik, PK Chattergee – Princiiples of Digital Communication NAI (P) Ltd, 2000

CESP 513
SPEECH SIGNAL PROCESSING

UNIT – I

Introduction – Signal and Linear Systems, Frequency analysis, Discrete-time signals and systems, filters.
Speech production and acoustic phonetics – Anotomy and psysiology of speech organs, articulatory phonetics, acoustic phonetics.
Short-time speech analysis – windowing, spectra of windows, signal – analysis in time domain, short time energy, magnitude, zero-crossing rate and auto correlation function, Frequency domain analysis – filter banks, formant estimation and tracking.

UNIT – II

Linear predictive coading (LPC) analysis – Basic principles, computation of LP coefficients, spectral estimation, window considerations, emphasizing low frequencies, pole-zero LPC models.
Cepstral analysis – Mathematical details, applications of the capstrum, Mel-scale capstrum, pitch estimation using time domain and short-time spectral techniques.

UNIT – III

Speech enhancement – Nature of interfering sounds, speech enhancement techniques, spectral subtraction, enhancement by resynthesis.
Automatic speech recognition – Basic pattern recognition approaches, parametric representation of speech, evaluating the similarity of speech patterns, spectral and temporal variability.

UNIT – IV

Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, training and testing using HMMs, adapting to variability in speech, language models.
Speaker recognition – Recognition techniques, features that distinguish speakers, system design, language and accent identification.

Text books :

1. Douglas O Shaughnessy, Speech Communications, second Edition, Oxford University Press, 2000
2. L.R Rabiner and S.W.Schafer. digital Processing of speech signals, Prentice Hall

References :

1. Owens, Signal Processing of Speech
2. Dellar and Proakis, Digital Signal Processing, PHI

CESP 514/1
IMAGE & VIDEO PROCESSING

UNIT – I

Color image processing – Color models – color transformations – smoothing and sharpening – image segmentation based on color – color image compression.

UNIT – II

Video formation, perception and representation – color perception and specification – video capture and display – analog video raster – analog color television systems
Digital video – Fourier analysis of video signals and frequency response of the human visual system.

UNIT – III

Video sampling – sampling of video signals – video sampling rate conversion – video modeling, Two dimensional motion estimation

UNIT – IV

Video coding systems – waveform based video coding – content dependent video coding.
Video compression standards – Error control in video communication

TEXT BOOKS

1. Digital Image Processing – 3rd Edition - Rafael C.Gonzalez, Richard E.Woods , Pearson Education, 2009. (For Unit –I only)

2. Video Processing and Communication – 1st edition - Yao Wang, J.Ostermann, Ya Zhang, Prentice Hall, 2001. (For Unit II,III and IV)

REFERENCE BOOKS

1. Image processing, analysis, and machine vision, 2nd Edition, - Sonka M, Hlavac V, Boyle R. Brooks Cole publishing, 1999.

2. Multidimensional, signal, image and video processing and coding, - Woods, Elsevier, Academic press, 2006.

CESP 514/2
WAVELET SIGNAL PROCESSING

UNIT - I

Orthogonal Signal Spaces, Approximations of Functions by a Set of Mutually Orthogonal Functions, Orthogonality in Complex Functions, Trigonometric & Exponential Fourier Series, Concepts of Fourier Transforms, Properties and their Significance, Energy and Power Spectral Density Functions.

UNIT-II

Time-Frequency Analysis: Window function, Short –Time Fourier Transform, Properties of Short-Time Fourier Transform, Discrete Short-Time Fourier Transform.
Continuous Wavelet Transform: Continuous-Time Wavelets, Definition of the CWT, The CWT as a Correlation, Constant Q-Factor Filtering Interpretation and Time-Frequency Resolution, The CWT as an Operator, Inverse CWT.

UNIT-III

Introduction to the Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Approximation of Vectors in Nested Linear Vector Subspaces, Example of an MRA.
MRA, Orthonormal Wavelets and their relationship to filter banks: Formal Definition of MRA, Construction of a General Orthonormal MRA, a wavelet basis for the MRA, Digital Filtering Interpretation, Interpreting Orthonormal MRAs for discrete-time signals.

UNIT-IV

Parseval's Identity for the CWT, Inverse CWT is a many to one operation, Wavelet Inner Product as a Projection Operation, CWT with an Orthonormal basis generating wavelet, A trous algorithm.
Biorthogonal Wavelet basis, filtering relationship for biorthogonal filters, two dimensional wavelets, wavelet packets.

TEXT BOOKS :

1. Signal Processing and Linear Systems, B.P. Lathi, Berkley Cambridge
2. Wavelet Transforms - Introduction to Theory and Applications, Raghuveer M. Rao, Ajit opardikar, Pearson Education, Asia

REFERENCES :

1. Signals and Systems, B.P. Lathi
2. Fundaments of Wavelets - Theory, Algorithms and Applications, Jaideva C. Goswami, Andrew K. Chan, John Wiley & Sons

CESP 514/3
RADAR SIGNAL PROCESSING

UNIT – I

Introduction – Radar functions and Applications, Target Detection, Resolution and Clutter , Basic Surveillance Radar – Implementation.
Radar Engineering Equation – Parameters, loss factors, Radar Detection with Noise, Jamming, Volume Clutter and Area Clutter, Detection Probability, false alarm sensitivity and introductions to CFAR Technique, Basics of CACFAR processor, Resolution Cell and Measurement Accuracy, Ambiguities in Range and Doppler.

UNIT – II

Signal Processing & Waveform Selection – 1 : Introduction, Matched Filter Processing (with examples), Matched Filter Receiver, Matched Filter and Correlation Function, Efficiency of Practical Filters, Effect of Transmitted waveform, Correlation Detection, Cross correlation Receiver.
Detection Criteria, Neyman Pearson Observer, Ideal Observer, Sequential Observer, Likelihood, Ration, Maximum Likelihood Function, Inverse Probability Criterion, Uncertainty Relation.

UNIT – III

Signal Processing & Waveform Selection – 1I : Transmit Waveforms, Types, Design Criteria, radar Ambiguity Function – Principles, Properties, Examples, Radar Environmental Diagram, Optimization, Desirability of Range – Doppler Ambiguities.
Phase Coding Techniques : Principles, Random Binary coding, Binary periodic Sequences, Ambiguity Function for PR Sequences, Maximal Length Binary Codes, Perfect words and Codes, Poly Phase Codes. Decoding Techniques, Analog and Digital Schemes, Noise and Clutter Performances.

UNIT – IV

Linear FM and Frequency Coding Techniques: Principles, Linear FM pulses, Generation and Decoding, Distortion effects on LFM Signals, Discrete Frequencies, Waveform Analysis, Capabilities, Resolution properties of Frequency Coded Pulses.

Text Books:

1. F.E. Nathanson, Radar Design Principles – Signal Processing and the Environment , McGraw-Hill, First Edition (1969)
2. Ramon Nitzberg, radar Signal Processing and Adaptive Systems, Artech House, 1999
3. M.I. Skolnik, Introduction to Radar Systems, McGraw-Hill
4. M.I. Skolnik (ed.) Radar Hand Book, McGraw Hill, wnd ed, 1992

CESP 515/1
SPREAD SPECTRUM COMMUNICATION

UNIT I

Direct Sequence Systems, definitions and concepts, Spreading sequences and waveforms, Systems with PSK Modulation, Quaternary Systems, Pulsed Interference, Rejection of Narrowband Interference.

UNIT II

Frequency Hopping Systems, Concepts and Characteristics, Modulations, Codes for partial band interference, Frequency Synthesizers.

UNIT III

Code Synchronization, Acquisition of Spreading sequences, Serial Search Acquisition, Acquisition correlator, code Tracking, Frequency Hopping Patterns.

UNIT IV

Detection of Spread Spectrum Signals, Detection of Direct sequence signals, Detection of Frequency Hopping Signals.

Text Book:

1.Principles of Spread Spectrum Communication Systems by Don.J.Torrieri, Springer Publishers,2005.

References:

1. Introduction to spread-spectrum communications by Roger L. Peterson, Rodger E. Ziemer, David E. Borth, Prentice Hall, 1995.
2. Spread Spectrum in Communications, R.Skaug, J.F.Hjelmstad, Published by Institution of Electrical Engineers.

CESP 515/2
ADVANCED SIGNAL PROCESSING

UNIT – I

POWER SPECIRAL ESTIMATION
Estimation of Spectra from Finite Duration Observations of a Signal, the Periodogram, Use of DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Turkey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods.

UNIT – II

PARAMETRIC METHOD OF POWER SPECTRUM ESTIMATION
Parametric Methods for power spectrum estimation, Relationship between Auto -Correlation and Model Parameters, AR(Auto-Regressive) Process and Linear prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Method, MUSIC Method.

UNIT III

Wiener Filtering: Introduction, The FIR Wiener Filter, Filtering, Linear Prediction, Noise Cancellation, Lattice Representation for the FIR Wiener Filter

UNIT IV

The IIR Wiener Filter, Non Causal IR Wiener Filter, The Causal Wiener Filtering, Causal Linear Prediction, Wiener Deconvolution, Discrete Kalman Filter.

TEXT BOOKS

1. ProakisJG and Manolakis DG Digital Signal Processing Principles, Algorithms and applications, PHI (For Unit I and II)
2. Statistical digital Signal Processing and Modelling by Monson Hayes, Wiley India Publications. (For Unit III and Unit IV)

REFERENCE BOOKS:

1. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.
2. Orfanadis S, Introduction to Digital Signal Processing PHI
3. Orfanadis S Optimum Signal Processing PHI

CESP 515/3
FIBRE OPTIC COMMUNICATION

UNIT – I

Optical Fibers: Optical Fiber Modes and Configurations: Fiber Types, Rays and Modes, Step-Index Fiber Structure, Graded – Index Fiber Structure. Fiber materials: a. Glass Fibers, Plastic Optical Fibers, Signal Degradation in Optical Fibers.
Attenuation: Attenuation Units, Absorption, Scattering Losses, Bending Losses, Core and Cladding Losses. Signal Distortion in Optical Waveguides: Information Capacity Determination, Group Delay, Material Dispersion, Waveguide Dispersion, intermodal Dispersion.

UNIT – II
Optical Sources: Light-Emitting Diodes (LEDs), LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation of an LED. Laser Diodes: Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, External Quantum Efficiency, Resonant Frequencies, Laser Diode Structures and Radiation Patterns, Single-Mode Lasers
Photo detectors: Physical Principles of Photodiodes, The pin Photo detector b.Avalanche Photodiodes ,Photo detector Noise, Detector Response Time, Avalanche Multiplication Noise, Structures for InGaAs APDs.

UNIT III

Optical Receiver Operation : Fundamental Receiver operation ,Digital Signal Transmission ,Error Sources ,Receiver Configuration, Preamplifiers.
Digital Transmission Systems : Point –to-Point Links ,System Considerations ,Link Power Budget,Rise – Time Budget WDM Concepts and Components.
Operational Principles of WDM : Passive Components, The 2 x 2 Fiber Coupler ,Scattering Matrix Representation, The 2 x 2 Waveguide Coupler ,Star Couplers ,Machzehnder Interferometer Multiplexers.

UNIT IV
Optical Networks: Basic Networks, Network Topologies , Performance of Passive Linear Buses Performance of Star Architectures. SONET/SDH : Transmission Formats and Speeds ,Optical Interfaces, SONET/SDH Rings, SONET/SDH Networks, FDDI Optical fiber.
Measurements : Introduction ,Fiber attenuation measurements, Fiber dispersion measurements, Fiber cutoff wave length measurements, Fiber numerical aperture measurements, Optical Time Domain Reflectometer (OTDR).

TEXT BOOKS
1.Gerd Keiser , Optical Fiber Communications , 3rd Edition , McGraw Hill.
2. John M.Senior Optical Fiber Communications, 2nd Edition, PHI.

CESP 516/1
ARTIFICIAL NEURAL NETWORKS

UNIT – I

Introduction: History of Neural Networks, Structure and functions of biological and artificial neuron, neural network architectures, Learning methods, evaluation of neural networks.

UNIT – II

Supervised learning – I: Single layer networks, McCulloch – Plus Neuron, Model Perceptron I carning, Delta learning Widrow – Hoff learning rules, linear seperability, Adaline and modifications.

UNIT – III

Supervised learning – II: Multi layer networks: Architectures, Madalines, Backpropagation algorithm, importance of learning parameter and momentum term, radial basis functions, polynomial networks.
Unsupervised learning: Winner – Take – all learning, out star learning, learning vector quantizers, counter propagation networks, Kohonen self-organizing networks, Grossberg layer, adaptive resonance theory, Hamming Net.

UNIT – IV

Assoctative memories: Hebbian learning rule, continuous and discrete, Hopfield networks, recurrent and associative memory, Boltzman machines, Bi-directional associative memory.
Applications of neural networks : Optimization, Travelling Salesman, Problem solving simultaneous linear equations, Applications in pattern recognition and Image Processing.

Text Books

1. J.M. Zurada Introduction to Artificial Neural Systems, Jaico Publications.
2. Kishan Mehrotra, Chelkuri K. Mohan, Sanjav Ranka, elements of Artificial Neural Networks, Tenram International.
3. B. Yegnanarayana, Artificial Neural Networks, PHI, New Delhi.
4. Waserman: Neural Computing – Theory and Practice.

CESP 516/2
ADAPTIVE SIGNAL PROCESSING

UNIT – I

Adaptive Systems :Definitions,Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner: Description, Weight Vectors, Desired Responses, Performance Function, Gradient and Mean-Suare Error.

UNIT – II

Approaches to the Development of Adaptive Filter Theory: Introduction to Filtering Smoothing and Prediction-Linear Optimum Filtering ,Problem Statement . Principle of Orthogonality , Minimum – Mcan- Squared Error, Winer –Hopf Equations, Error Performance , Normal Equation .

UNIT – III

Searching the Performance Surface – Methods and Ideas of Gradient Search Methods, Gradient Searching Algorithm and its Solution, Stability and Rate of Convergence, Learning Curves, Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

LMS Algorithms – Overview, LMS Adaptation Algorithms, Stability and Performance Analysis of LMS Algorithms, LMS Gradient and Stochastic Algorithms, Convergence of LMS Algorithms.

UNIT – IV

Applications – Noise Cancelling, Cancelling Echoes in Long Distance Telephone Circuits, Adaptive Beam Forming.

Kalman Filtering Theory – Introduction, Recursive Mean Square Estimation for Scalar Random Variables, Statement of Kalman Filtering Problem, Innovation Process. Estimation of State using the Innovation Process, Filtering, Initial Conditions, Summary of Kalman Filters, Variants of the Kalman Filtering the Extend Kalman Filtering, Identification as a Kalman Filtering Problem.

TEXT BOOKS:

1. Bernand Widrow – Advaptive Signal Processing, PH/Pearson Education, Asia.
2. Simon Haykins - Adaptive filter Theory , PH

REFERENCES :

1. Sophocles J. Orfamidis - Optimum Signal Processing – An Introduction, 2nd Edition, McGraw Hill
2. S. Thomas Alexander – Adaptive Signal Processing – Theory and Applications, Springer – Verlag

CESP 516/3
MICROWAVE MEASUREMENTS

UNIT – I

Measurement of wavelength and frequency, Equivalent circuit of the cavity wave meters, typical wavemeters, resonant cavities.
Methods of Frequency Measurements: Direct measurement, Interpolation method, Additive frequency method.

UNIT – II

Measurement of Impedance : Constructional details of slotted section and its limitations, standing wave detector, Techniques in standing wave detector measurements, Measurement of low & high VSWR., Location of voltage minims, Use of Smith chart in impedance measurements, Errors in standing wave detector impedance measurements, Reflectometers.
Measurement of Power : Methods of power measurement, Typical barrette elements, thermistor, bolometer bridge circuits, Extending the range of Bolometer devices, Crystal Detector, Dielectric Measurement for Solids.

UNIT – III

Measurements on Microwave circuits and components, T and P network, Measurement of scattering coefficients, Graphical determination of scattering coefficients, Coupling and Directivity of directional coupler.

UNIT – IV

Measurement of Attenuation: Insertion of Power ratio method, substitutionmethod, scattering coefficient method, Return Loss.
Antenna Measurements: Measurement of radiation patterns, Antenna gain measurements, Antenna impedance Measurements, Polarization Measurements.

TEXT BOOKS

1. E.L. Ginzton, Microwave Measurements, Mc Graw Hill
2. Annapurna Das & Sisir K Das, Microwave Engineering, TMH, 2000
3. P. Rizzi, Microwave Engineering Passive Circuits, Prentice Hall, 1987
4. D.M. Pozar, Microwave Engineering, John Wiley, 1998

REFERENCE BOOKS :

1. M.L. Sisodia & GS Raghuvanshi, Basic Microwave Techniques and Laboratory Manual, Wiley Eastern, 1987
2. Dennis Roddy, Microwave Technology, PHI, 1986

CESP 551
COMMUNICATION LAB

List of Experiments

1. Time Division Multiplexing of signals & Framing in the TDM.
2. Study of Manchester Coder – Decoder.
3. Forming a PC to PC Communication Link using Optical Fiber and RS 232 interface.
4. Measurement of various losses in an Optical Fiber.
5. Comparative study of EMI in copper and Optical media.
6. Study of Optical Time Domain Reflectometer.
7. Measure the Scattering parameters of the devices: Circulator & Hybrid TEE.
8. Study of Antenna Radiation Patterns of E-Plane and H-plane radiation patterns of a Pyramadal horns.
9. Study of spectrum analyzer.
10. Measurement of Q-factor of cavity resonator.
11. Study of Cellular communication Systems.
12. Study of Satellite communication Receiver.

Note: A minimum of 10 (ten) experiments have to be performed and recorded by the candidate to attain eligibility for the university practical examination.

CESP 521
REALTIME SIGNAL PROCESSING

Unit – I

Introduction: Introduction to realtime concepts, Signal Processing and DSP systems, Comparison between general purpose and DSP processors.
Architecture: TMS320C6x Architecture, Functional Units, Fetch and Execute, Packets, Pipelining, Registers.
Addressing modes: Direct, Indirect Addressing Linear and Circular Addressing Modes, Circular Addressing.

Unit – II

Instruction Set of the C6x Processor : TMS320C6x Instruction Set, Assembly Code Format, Types of Instructions , Assembler Directives, Timers, Interrupts, Interrupt Control Registers , Interrupt Acknowledgment , Multichannel Buffered Serial Ports , Direct Memory Access , Memory Considerations, Data Allocation, Data Alignment, Pragma Directives, Memory Models.

Data representation DSP Processors : Data Types, Floating-Point Format, Q-format Number Representation Fixed-Point DSP, Finite Word Length Effects on Fixed-Point DSPs, Overflow and Scaling, Division, Code Improvement , Trip Directive for Loop Count, Cross-Paths, Software Pipelining, Constraints , Memory Constraints, Cross-Path Constraints, Load/Store Constraints, Pipelining Effects with More Than One EP within an FP.

Unit – III

Finite Impulse Response Filters : Introduction to the *z*-Transform, Mapping from *s*-Plane to *z*-Plane, Difference Equations, Discrete Signals, FIR Filters,FIR Lattice Structure,FIR Implementation Using Fourier Series, Window Functions, Hamming Window, Hanning Window, Blackman Window, Kaiser Window, Computer-Aided Approximation.
Infinite Impulse Response Filters:IIR Filter Structures, Direct Form I Structure 178, Direct Form II Structure, 5.2.3 Direct Form II Transpose, Cascade Structure, Parallel Form Structure, Lattice Structure, Bilinear Transformation, BLT Design Procedure, Programming Examples Using C and ASM Code.

Unit – IV

Fast Fourier Transform: Development of the FFT Algorithm with Radix-2, Decimation-in-Frequency FFT Algorithm with Radix-2, Decimation-in-Time FFT Algorithm with Radix-2, Bit Reversal for Unscrambling, Development of the FFT Algorithm with Radix-4, Inverse Fast Fourier Transform.

Adaptive Filters: Introduction, Adaptive Structures, Adaptive Linear Combiner, Performance Function Searching for the Minimum, Programming Examples for Noise Cancellation and System Identification

Code Optimization: Introduction to optimization, Optimization Steps, Procedure for Code Optimization, Software Pipelining for Code Optimization, and Execution Cycles for Different Optimization Schemes.

Text books :

1. Digital Signal Processing and Applications with the C6713 and C6416 DSK
   Rulph Chassaing, A JOHN WILEY & SONS, INC., PUBLICATION.

Reference books :

1. *Real-Time Digital Signal Processing Based on the TMS320C6000 by Nasser Kehtarnavaz.*

2. Digital Signal Processors: Architectures, Implementations, and Applications...
   By Kuo, woon seng – s gen, Pearson education.

3. Digital signal processorsarchitecture, programming and applications, by B. Venkataramani, M. Bhaskar, TMH Edition.

4. Digital signal processing implementationsusing DSP microprocessors with examples from TMS320C54xx by Avtar Singh, Srini Srinivasan, Thomson/Brooks/Cole, 2004

CESP 522
MULTIRATE SYSTEMS AND FILTER BANKS

UNIT I

Fundamentals of Multirate Systems: Basic Multirate Operations, Interconnection of Building Blocks, The Polyphase representation, Multistage Implementations, Some Applications of Multirate Systems, Special Filters and Filter Banks.

UNIT II

Maximally Decimated Filter Banks: Errors created in the QMF Bank, A Simple Alias Free QMF System, Power Symmetric QMF Banks, M-Channel Filter Banks, Polyphase representation, Perfect Reconstruction Systems, Alias Free Filter Banks, Tree Structured Filter Banks, TransMultiplexers.

UNIT III

Paraunitary Perfect Reconstruction (PR) Filter Banks: Lossless Transfer Matrices, Filter Bank Properties Induced by Paraunitariness, Two channel FIR Para unitary QMF Banks, The Two channel Para unitary QMF Lattice, Transform Coding and the LOT.

UNIT IV

Cosine Modulated Filter Banks: The Pseudo QMF Bank, Design of Pseudo QMF Bank, Efficient Polyphase Structures, Deeper Properties of Cosine Matrices, Cosine Modulated Perfect Reconstruction Systems.

TEXT BOOK:

1. Multirate Systems and Filter Banks, P.P.Vaidyanathan, Pearson Education, Low Priced Edition, 2006.

REFERENCE BOOKS:

1. Multirate Signal Processing for Communication Systems by F.J.Harris, Pearson Education, Low Priced Edition.
2. Digital Signal Processing, A computer Based Approach by Sanjit K Mitra, Tata Mc Graw Hill Publishing.

CESP 523
WIRELESS COMMUNICATION

UNIT – I

Introduction :– Evaluation of Mobile Radio Communication, Mobile Radio Systems around the world, Examples of Wireless Communication Systems: Paging systems, Cordless Telephone Systems, Cellular Telephone Systems.

Modern Wireless Communication Systems: Second generation cellular networks, third generation networks, Wireless Local Loop (WLL) LMDS, Wireless Local Area Networks (WLAN), Bluetooth & Personal Area Networks.

UNIT – II

The Cellular Concept – System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems.

Mobile Radio Propagation: Large-Scale Path Loss: Introduction, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection, Diffraction Scattering, Practical Link Budget Design Using Path Loss Models, Outdoor Propagation Models-(Longley Rice Model & Durkin's Model_ A Case Study), Indoor Propagation Model (Partition Losses (Same Model) & Partition Losses between Floors), 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, Examples of Fading Behavior, Second-Order Statistics Using Shape Factors, Applying Shape Factors to Wideband Channels, Revisiting Classical Channel Models with Shape Factors.

UNIT – IV

Review of the Modulation Techniques for mobile radio, Review of the Multiple Access techniques for Wireless Communication, Wireless data networking, Wireless Data Services, AMPS, Global System for Mobile (GSM).

Text Books:

1. TS Rappaport, wireless communications: principles and practice, Pearson education 2nd edition.
2. J G Proakis, Digital Communication, McGraw Hill, 1995.
3. GE Stuber, Principles of Mobile Communications, KIuwer academic 1996.

CESP 524/1
EMBEDDED SYSTEMS

UNIT – I

Introduction :
Introduction to Embedded System, Role of processor selection in Embedded Systems, Embedded System project management, design cycle in the development phase for an Embedded System, using of target system or its Emulator and in-Circuit emulator, use of software tools for development of an Embedded Systems.

UNIT – II

RTOS and its overview:
Real Time Operating Systems: Task and Task States, Tasks and Data, Message Queues, Timers and Timer Functions, Events Memory Management , Interrupt Routines in an RTOS environment, Basic Design Using RTOS.

UNIT – III

Embedded system development :
Interfacing of external memory, interfacing of analog and digital blocks, interfacing of different peripheral devices LEDs, LCDs, Graphical LCD, Switches, Relay, Stepper motor, ADC, DAC, and various sensors, introduction to assembler, compiler, cross compilers, and Integrated Development Environment.

UNIT – IV

Net works for Embedded Systems:
The I^2C Bus, The CAN bus, SHARK link ports, Ethernet, Introduction to Bluetooth: specification, Core protocol. IEEE 1149.1 (JTAG) Testability

TEXT BOOKS :

1. The art of programming Embedded systems, Jack G. Ganssle, academic press.
2. Intelligent Embedded systems, Louis L. Odette, Adison Wesly , 1991.
3. J. Starustrup and W. Wolf Hardware software Co Design principles and practice. KJluwer, Academic Publications.

REFERENCE BOOKS:

1. Design with PIC microcontroller bu john B. Pitman, pearson edition.
2. Designing Embedded Systems Hardware : John Catsoulis, Shroff Publications, Distributors New Delhi.
3. Microcenters Architecture Programming, Interfacing and system design by Raj Kamal, Pearson edition.
4. Programming Embedded systems in C and C++, Micheel Barr, Shroff Publications, Distributors New Delhi.

CESP 524/2
PATTERN RECOGNITION

UNIT – I

Importance of pattern recognition, Features, Feature Vectors and Classifiers, Supervised, Unsupervised and Semi Supervised Learning.
Classifiers based on Baye's Decision Theory: Baye's decision theory, Discriminant Functions and decision surfaces, Bayesian classification for Normal Distributions, Estimation of Unknown probability density functions, The Nearest Neighbor Rule.

UNIT – II

Linear Classifiers Linear Discriminant functions and Decision Hyperplanes, The perceptron Algorithm, Least Squares Method.
Support Vector Machine: Separable classes, Nonseparable classes, The multiclass case, v-SVM, Support Vector Machines-A geometric View Point

UNIT - III

Non Linear Classifiers: The XOR problem, The two layer perceptron, Three layer perceptrons, The Backpropagation Algorithm, The cost function choice, choice of the network size, A simulation example, Networks with weight sharing, generalized linear classifiers, polynomial classifiers, Radial basis Function Networks

UNIT – IV

Feature Selection: Pre processing, The peaking phenomenon, Feature selection based on statistical hypothesis testing, ROC curve, class separability measures, feature subset selection,
Feature Generation: Basis Vectors and Images, The KL Transform, The Singular Value Decomposition, Independent Component Analysis, Non negative Matrix Factorization, Regional features, Features for shape and size characterization.

Text Book:

1. Pattern Recognition (4 edition) by Sergios Theodoridis, Konstantinos Koutroumbas, Academic Press, 2009.

Reference Books:

1. Pattern Classification (2 edition) – Richard Duda, Peter E Hart, David G Stork, John Wiley & Sons, 2001.
2. Pattern Recognition and Machine Learning , Christopher M.Bishop, Springer Publications 2006.

CESP 524/3
RANDOM PROCESSING & INFORMATION THEORY

UNIT –I

RANDOM VARIABLES: Definition of Random Variable, Probability of Distribution Function, Probability Density Function(PDF), Conditional and Joint Distribution and Densities, Functions of Random Variables, Determining the PDF of Y = g(X), Expected value of a Random Variable, Conditional Expectations, Moments, Joint Moment, Properties of Uncorrelated Random Variables, Jointly Gaussian Random Variables.

UNIT –II

RANDOM PROCESSES: Introduction, Mathematical definition of a Random Process, Stationary Processes, Mean, Correlation, and Covariance Functions, Ergodic Processes, Transmission of a Random Process through a Linear Time-invariant Filter, Power Spectral Density, Gaussian Process, Noise, Narrowband Noise, Representation of Narrowband Noise in terms of In-phase and Quadrature Components, Representation of a Narrowband Noise in terms of Envelope and Phase Components.

UNIT –III

ADVANCED TOPICS IN RANDOM PROCESSES: Mean square (m.s.) calculus, Stochastic Continuity and Derivatives, Further results on m.s. Convergence, m.s. Stochastic Integrals, m.s. Stochastic Differential Equations, Karhunen-Loeve Expansion, Representation of Band limited and Periodic Processes, Band limited processes, Band pass Random Processes.

UNIT –IV

APPLICATION TO STATISTICAL SIGNAL PROCESSING: Estimation of random variables, innovation sequences and Kalman filtering, wiener filters for random sequences, hidden markov models.

TEXT BOOKS:

1. Probability and random processes henry stark john w. woods, 3"° pea
2. Communication systems simon haykin, 4th ed
3. Probability and random variables pebbels
4. Probability, random variables and stocastic processes
   papoolis

CESP 525/1
SATELLITE COMMUNICATION SYSTEMS

UNIT – I

INTRODUCTION AND ORBITAL ASPECTS OF SATELLITE COMMUNICATIONS: A brief history of Satellite Communications, Types of Orbits, Orbital Mechanics: Developing the Equation of the orbit, Kepler's laws of planetary motion, locating the satellite in the orbit, locating the Satellite with respect to the Earth, Orbital elements, Look angle determination, Orbital perturbations, launch and launch vehicles, Orbital effects in Communication System performance.

UNIT – II

SATELLITE SUBSYSTEMS: Introduction, Attitude and Orbit Control System (AOCS), Telemetry, Tracking, Command and Monitoring (TTC&M), Power Systems, Communication Subsystems, Satellite Antennas

MULTIPLE ACCESS TECHNIQUES: Introduction, FDMA, TDMA, DAMA and CDMA Satellite Systems Encoder, Decoder, Comparison between FDMA, TDMA & CDMA .

UNIT – III

SATELLITE LINK DESIGN: Basic transmission theory,System Noise Temperature and G / T ratio, Design of Uplink and Down link models, Design of Satellite links for specified C / N ratio.

EARTH STATION TECHNOLOGY: Earth Station Design, Design of large antennas, Small earth station Antennas, Propagation Effects on Satellite: Quantifying Attenuation and Depolarization, Rain and Ice Effects, Prediction of Rain Attenuation.

UNIT – IV

SATELLITE PACKET COMMUNICATIONS**:** Message transmission by FDMA: The M/G/1 Queue, Message transmission by TDMA - Pure ALOHA: Satellite packet switching - slotted ALOHA -Packet Reservation – Tree algorithm.

VSAT SYSTEMS : Introduction, overview of VSAT Systems, Network Architectures, One – way Implementation, Split – Two-Way (Split IP) Implementation, Two-Way Implementation, Access Control Protocols, Delay Considerations, Basic Techniques: Multiple Access Selection, Signal Formats, Modulation, Coding, and Interference Issues.

TEXT BOOKS:

1. T Pratt and W Bostiain, Satellite Communications, 2nd Edition, John Wiley,
2. Tri T. Ha Digital Satellite communications , 2nd Edition, McGraw Hill
3. Taub and Schilling, Principles of Communication Systems, TMH, 2003.
4. Simon Haykin, Communication Systems, 4th Edition, John Wiley & Sons, 2004.

REFERENCE BOOKS:

1. D C Agarwal, Satellite Communications, Khanna Publishers, 2003
2. Robert M Gagliardi, Satellite Communications.

CESP 525/2
GLOBAL POSITIONING SYSTEMS

UNIT I

Overview of GPS: Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

UNIT II

GPS Signals, Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

UNIT III

GPS coordinate frames, Time references: Geodetic and Geo centric coordinate systems, ECEF Coordinate world geodetic 1984 (WGS 84), GPS time.

UNIT IV

GPS orbits and satellite position determination : GPS orbital parameters, description of receiver independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination. GPS Errors :
GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

TEXTBOOKS :

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).

REFERENCE BOOKS :

1. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

CESP 525/3
TELECOMMUNICATION SWITCHING SYSTEMS

UNIT I

TELECOMMUNICATION SWITCHING SYSTEMS: Evolution of Telecommunications Simple Telephone Communication Basics of Switching System Electronic Space Division Switching Stored Program Control Centralized SPC Distributed SPC Software Architecture Two Stage Networks Three Stage Networks N Stage Networks Time Division Switching Basic Time Division Time Switching Combination Switching Three Stage Combination Switching N Stage Combination Switching

UNIT II

TELEPHONE NETWORKS: Subscriber Loop Systems Switching Hierarchy and Routing Transmission Plan Signaling Techniques In-channel Signaling Common Channel Signaling Network Traffic Load and Parameters Grade Of Service and Blocking Probability

FUNDAMENTAL CONCEPTS OF DATA COMMUNICATIONS: Data Communications Codes Bar Codes Character Synchronization Data Communications Hardware Data Communications Circuits Line Control Unit Serial Interfaces

UNIT III

DATA-LINK PROTOCOLS AND DATA COMMUNICATIONS NETWORKS: Introduction Data Link Protocol Functions Character- and Bit- Oriented Data Link Protocols Asynchronous Data-Link Protocols Synchronous Data-Link Protocols Synchronous Data-Link Control High-Level Data-Link Control Public Switched Data Networks Asynchronous Transfer Mode

DIGITAL T-CARRIERS AND MULTIPLEXING: Time-Division Multiplexing T1 Digital Carrier North American Digital Hierarchy Digital Carrier Line Coding T Carrier Systems European Digital Carrier System Digital Carrier Frame Synchronization Bit Versus Word Interleaving Statistical Time Division Multiplexing Frequency Division Multiplexing FDM Hierarchy Composite Baseband Signal Formation of a Master Group

UNIT IV

ISDN: What Is ISDN? ISDN Components ISDN Channel Types Basic and Primary Rate Interfaces ISDN Protocols ISDN Features Services and Applications Other ISDN Initiatives

DIALUP AND HOME NETWORKING: What Is Dialup Networking? Analog Modem Concepts DSL Service Cable Modems Home Networking Concepts and Issues

NETWORK CONVERGENCE: What Is Network Convergence? Networking Issues and Convergence Effects of Network Convergence on Business Convergence At Home

TEXT BOOKS:

1. T Viswanathan, Telecommunication Switching Systems and Networks, PHI, 2004
2. Wayne Tomasi, Advanced Electronic Communications Systems, Pearson, 6th Edition, 2004
3. Machael A. Gallo and William M. Hancock, Computer Communications and Networking Tecnologies, Cengage Learning, 1st Edition, 2002

REFERENCE BOOKS:

1. J E Flood, Telecommunications Switching, Traffic and Networks, Person, 1999
2. Ray Horak, Communication Systems and Networks, 3rd Edition, Wiley, 2002

CESP 526/1
FUZZY TECHNIQUES

UNIT – I

Classical and fuzzy sets: Classical sets- operations, properties of classical sets, mapping of classical sets to the functions. Fuzzy sets-membership, uncertainty, fuzzy set operations, properties of fuzzy sets. Classical and fuzzy relations: Cartesian product, crisp relations-cardinality, operations and properties of crisp relations, Fuzzy relations-cardinality operations and properties of fuzzy relations. Non interacting fuzzy sets, Tolerance and equivalence relations.

UNIT – II

Membership functions: Futures of membership functions, fuzzification, membership value assignments-intuition, ranking ordering, angular fuzzy sets, neural nets, genetic algorithms, inductive reasoning, Fuzzy-to-crisp conversions: Lambda-cuts for fuzzy sets, lambda-cuts for fuzzy relations, defuzzification methods. Fuzzy arithmetic, numbers and vectors and extension principle: fuzzy members, approximate methods of extension-vertex method, DSW algorithm, restricted DSW algorithm, fuzzy vectors.

UNIT – III

Classical logic and fuzzy logic: Classical predicate logic-tautologies, contradictions, equivalence, exclusive or and exclusive nor, logical proofs, deductive inferences. Fuzzy logic, approximate reasoning, Fuzzy tautologies, contradictions, equivalence and logical proofs, other forms of the implication operation, other forms of the composite operation. Fuzzy rule-based systems: Natural language, linguistic Hedges, rule-based systems-canonical rule forms, decomposition of compound rules, likelihood and truth qualification, aggregation of Fuzzy rules, Graphical techniques inference.

UNIT – IV

Fuzzy decision-making: Fuzzy synthetic evaluation, fuzzy ordering, preference and consensus, Multi objective decision making, Fuzzy Bayesian Decision method, Decision making under Fuzzy states and fuzzy actions. Fuzzy classification: Classification by Equivalence Relations-crisp relations, Fuzzy relations, Cluster validity, C-Means clustering-Hard C-Means (HCM). Fuzzy C-Means (FCM), classification Metric, Hardening the Fuzzy C-partition, similarity relations from clustering.

TEXT BOOKS:

1. Timothy J. Ross, Fuzzy logic with engineering applications, Mc Graw Hill, 1997
2. Klir and Ywan, Fizzy sets and Fuzzy logic, Prentice Hall of India
3. S.Rajasekharan & Y.A.Vijayalakshmi Pai, Neural Networks, Fuzzy logic and Genetic Algorithms, Prentice Hall of India

REFERENCE BOOK

1. Fuzzy - Neural Control: Principles, Algorithms and applications by Nie and Linkens, PHI.

CESP 526/2
OPTIMIZATION TECHNIQUES

UNIT I

Classical Optimization Techniques Single variable optimization – Multivariable optimization with no constraints – Hessian matrix – Multivariable saddle point – Optimisation with equality constraints – Lagrange multiplier method – Multivariable optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT II

One dimensional unconstrained minimization.Elimination methods – unrestricted search method – Fibonacci method – Interpolation methods – Quadratic interpolation and cubic interpolation methods.Unconstrained minimization. Gradient of a function – steepest descent method – Newton's method – Powell's method – Hooke and Jeeve's method.

UNIT III

Integer – Linear programming problem Gomory's cutting plane method – Gomory's method for all integer programming problems, mixed integer programming problems.Network techniques. Shortest path model – Dijkstra's algorithm – Floyd's algorithm – minimum spanning tree problem – PRIM algorithm – Maximal flow problem algorithm.

UNIT IV

Genetic Algorithms, Basic Concepts, Working Principle, Encoding, Fitness Function, Reproduction.

TEXT BOOKS:

1. Optimization theory and application – S. S. Rao, New Age International P Ltd.
2. Neural Networks, Fuzzy Logic and Genetic Algorithms Synthesis and Applications by S.Rajasekaran, G.A.Vijayalakshmi Pai, Prentice Hall of India Publishing,2007.

REFERENCE BOOKS:

1.Optimisation concepts and applications in Engineering – A. D. Belegundu, T. R. Chandrupatla, Pearson Education Asia.

CESP 526/3
ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING

UNIT I

OFDM TRANSMISSION OVER WIDEBAND CHANNELS

Evolution and Applications of OFDM - Choice of OFDM – Modulation -Performance over AWGN channels - Clipping amplification - AID conversion - Phase noise - Wideband channel models - Effects of time dispersive channels - Channel transfer function estimation – System performance and inter subcarrier cancellation.

UNIT II

TIME AND FREQUENCY DOMAIN SYNCRONIZATION

Performance with Frequency and Timing errors- Synchronization algorithms- omparison of frequency acquisition algorithms- BER performance with frequency synchronization- OFDM synchronization performance.

UNIT III

ADAPTIVE SINGLE - AND MULT USER OFDM

Adaptive modulation - Adaptive OFDM speech system - Pre-equalization - Comparison of adaptive techniques - Power and Sit allocation algorithms - Multi user AOFDM - Block coded AOFDM. Adaptive modulation schemes for OFDM. PMEPR analysis of OFDM systems

UNIT IV

OPTICAL OFDM

Basic configuration - Spectra! Efficiency - Transmission over SMF and MivlF - M/D system - Wireless over Optical **...** 100ps/**div**. – Optical components Div.. - PAPR reduction techniques - Power efficient Optical OFDM - Dispersion compensation.

TEXT BOOKS

1. Lajos Hanzo, M.yunster, B.J.Cho! and T. Keller, " OFDM and *MC* - *COMA* for Broadband Multi user Communications - WLANs and Broadcasting", *John* Wiley and sons, IEEE press, 2003.

2. Ramjee Prasad, "OFDM for wireless Communication Systems", Artech House Publishers, **2004.**

CESP 561 SIGNAL PROCESSING LABS

S.No.	List of Experiments
1.	**Program to perform Edge detection using several operators.**
2.	**Program to perform Image compression using JPEG standard.**
3.	**Program to implement various spatial and frequency domain filters for images.**
4.	**Program to implement enhancement techniques for color images.**
5.	**Program to perform Point detection & Line detection.**
6.	**Program to separate the frames in a video and process them.**
7.	**Implementation of Digital Data Scrambler.**
8.	**Implementation of Digital Data Descrambler.**
9.	**Implementation of Convolutional Encoder.**
10.	**Implementation of Viterbi decoder.**
11.	**Implementation of Adaptive Filter.**
12.	**Program to perform Linear convolution using DSP Processor.**
13.	**Program to perform Circular convolution using DSP Processor.**
14.	**Program to perform FFT operation using DSP Processor.**
15.	**Program to perform DFT operation using DSP Processor.**

Note: A minimum of 10 (ten) experiments have to be performed and recorded by the candidate to attain eligibility for the university practical examination.