E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with „A" Grade | Accredited by NBA (CSE, EEE, MECH)

NAGAPATTINAM – 611 002

M.E. COMMUNICATION SYSTEMS

Full Time Curriculum and Syllabus

First Year – First Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1701CO101	Applied Engineering Mathematics	2	2	0	3	40	60	100
1702CO102	Advanced Digital Signal Processing	2	2	0	3	40	60	100
1702CO103	High Speed Communication Networks	3	0	0	3	40	60	100
1702CO104	Advanced Digital Communication	3	0	0	3	40	60	100
1702CO105	Wireless Communication Engineering	3	0	0	3	40	60	100
	Elective - I	3	0	0	3	40	60	100
Laboratory Course								
1704CO106	Signals Processing and Communication Laboratory	0	0	4	2	50	50	100
1704CO107	Wireless Communication Networks Lab	0	0	4	2	50	50	100
1704CO108	Communication Skills Laboratory - I	0	0	2	1	100	0	100

L – Lecture | T – Tutorial | P – Practical | C – Credit | CA – Continuous Assessment | ES – End Semester

1701CO101	APPLIED ENGINEERING MATHEMATICS	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

1. To expose the students to solve ordinary differential equations by various techniques.
2. To understand basic concepts of advanced techniques in Matrix operations, linearequations.
3. To acquire the knowledge of interest in Special functions

UNIT I LINEAR PROGRAMMING 9 Hours

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT II ADVANCE MATRIX THEORY 9 Hours

Diagonalization of symmetric matrices - Quadratic forms - Singular values decomposition - Change of basis, Cramer˝s rule, Matrixfactorizations

UNIT III ORDINARY DIFFERENTIAL EQUATIONS 9 Hours

Runge-Kutta Methods for system of IVPs, numerical stability, Adams-Bash forth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerk in finite element method.

UNIT IV LINEAR ALGEBRA 9 Hours

Vector spaces – norms – Inner Products – QR factorization - generalized eigenvectors – Canonical forms – singular value decomposition and applications - pseudo inverse – least square approximations --To eplitz matrices and some applications

UNIT V SPECIAL FUNCTIONS 9 Hours

Bessel˝s equation – Bessel functions – Legendre˝s equation – Legendre˝s polynomials – Rodrigue˝s formula – Recurrence relations – Generating functions and orthogonal property for Bessel˝s functions– Strum-Liouville problem – Error functions.

TOTAL: 30 + 15 HOURS

FURTHER READING:

Matrix norms - Jordan canonical form - Pseudo inverse - Least square approximations - QR algorithm

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Have knowledge in the fields of linear algebra and linear programming

CO2 Provide the students with outstanding educational skills that will enable them to integrate under graduate fundamentals with advanced knowledge to solve complex problems

CO3 Recall combination of theoretical knowledge and independent mathematical thinking using special functions

REFERENCES:

1. Elsgolts. L, Differential Equation and Calculus of variations, MIR Publishers, 1996
2. Grewal B S, Higher Engineering Mathematics, Fortieth Edition, Khanna Publications, New Delhi 2014.
3. Howard. A. Anton,“ Elementary Linear Algebra”, John Wiley & Sons, NinthEdition,2008.
4. David C. Lay, Steven R Lay and Judy J McDonald “Linear Algebra and it Applications”, Global Edition Pearson Education Ltd,2015
5. Rai Singhania. M. D, Ordinary and partial differential equations, S. Chand & Co, New Delhi, 2006.
6. SeymourLipschutz,MarcLipson,“Schaum'sOutlineofLinearAlgebra”,McGrawHill,FifthEdition,2013
7. Taha H.A. ―Operations Research: An introduction‖ Ninth Edition, Pearson Education, Asia, New Delhi 2012

1702CO102	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

1. To explore the concepts of multi rate signal processing and multi rate filters.
2. To study the adaptive filters and its applications.
3. To know about Linear and Prediction concepts.
4. To learn fundamental concepts on signal processing in power spectrum estimation.

UNIT I MULTI RATE DIGITAL SIGNAL PROCESSING 9 Hours

Introduction-Sampling and Signal Reconstruction-Sampling rate conversion – Decimation by an integer factor – interpolation by an integer factor –Sampling rate conversion by a rational factor – poly-phase FIR structures – FIR structures with time varying coefficients - Sampling rate conversion by a rational factor- Multistage design of decimator and interpolator.

UNIT II MULTI RATE FIR FILTER DESIGN 9 Hours

Design of FIR filters for sampling rate conversion –Applications of Interpolation and decimation in signal processing –Filter bank implementation –Two channel filter banks-QMF filter banks –Perfect Reconstruction Filter banks – tree structured filter banks - DFT filter Banks – M-channel filter banks-octave filter banks

UNIT III LINEAR ESTIMATION AND PREDICTION 9 Hours

Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.

UNIT IV DESIGN OF ADAPTIVE FILTERS 9 Hours

FIR Adaptive filters - Newton's steepest descent method – Adaptive filters based on steepest descent method - LMS Adaptive algorithm – other LMS based adaptive filters- RLS, Exponentially weighted RLS - Sliding window RLS – Simplified IIR Application: channel equalization, noise cancellation, prediction.

UNIT V POWER SPECTRAL ESTIMATION 9 Hours

Estimation of spectra from finite duration observations of a signal –The Periodogram-Use of DFT in Power spectral Estimation –Non-Parametric methods for Power spectrum Estimation – Bartlett. Welch and Blackman–Tukey methods –Comparison of performance of Non – Parametric power spectrum Estimation methods – Parametric Methods - Relationship between auto correlation and model parameters, Yule-Walker equations, solutions using Durbin¨s algorithm, AR, MA, ARMA model based spectral estimation.

TOTAL: 45 + 15 HOURS

FURTHER READING:

Applications of adaptive filters: Adaptive channel equalization Adaptive echo canceller - Adaptive noise cancellation-, 1/M-octave-band filter banks, Speech enhancement using spectrum estimation

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Design and implement decimator and interpolator and to design multi rate filter bank and acquires knowledge of how a multi rate system work

CO2: Understand different spectral estimation techniques and linear prediction

CO3: Explain about LMS and RLS adaptive filters for signal enhancement, channel equalization

CO4: Illustrate different Power spectrum methods and solutions

REFERENCES:

1. H. Monson Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc., 2008.
2. G. John Proakis and G. Dimitris Manolakis, Digital Signal Processing, Pearson Education, 2006.
3. P.P.Vaidyanathan, Multirate Systems and Filter Banks, Pearson Education, 2008.
4. N.J.Filege, Multirate Digital Signal Processing, John Wiley and Sons, 2000.
5. G.John Proakis, Algorithms for Statistical Signal Processing, Pearson Education, 2002.
6. G.Dimitris and G.Manolakis,Statistical and Adaptive Signal Processing, McGraw Hill, 2002.
7. Sophoncles J. Orfanidis, Optimum Signal Processing, McGraw Hill, 2007.

1702CO103	HIGH SPEED COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To develop a comprehensive understanding of multimedia networking.
2. To study the types of VPN and tunneling protocols for security.
3. To learn about network security in many layers and network management.

UNIT I INTRODUCTION 9 Hours

Review of OSI,TCP/IP; Multiplexing, Modes of Communication, Switching, Routing .SONET– DWDM–DSL– ISDN–BISDN,ATM.

UNIT II MULTIMEDIANETWORKING APPLICATIONS 9 Hours

Streaming stored Audio and Video–Best effort service–protocols for real time interactive applications–Beyond best effort–scheduling and policing mechanism –integrated services– RSVP-differentiated services.

UNIT III ADVANCED NETWORKS CONCEPTS 9 Hours

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

UNIT IV TRAFFIC MODELLING 9 Hours

Little"s theorem, Need for modeling, Poisson modeling and its failure, Non-poisson models, Network performance evaluation.

UNIT V NETWORK SECURITYAND MANAGEMENT 9 Hours

Principles of cryptography –Authentication–integrity–key distribution and certification–Access control and: firewalls–attacks and counter measures–security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration–ASN.1

TOTAL: 45 HOURS

FURTHER READING:

IP Switching ,Ipv6,Ipv6 over ATM

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Know basics of networks
CO2 Understand applications of multimedia networking
CO3 Examine advanced networking techniques
CO4 Illustrate traffic modeling concepts
CO5 Know security basics and its management

REFERENCES:

1. J.F. Kurose &K.W. Ross," Computer Networking- A top down approach featuring the internet", Pearson 2nd edition, 2003.
2. Walrand.J. Varatya ,High performance communication network, Morgan Kauffman– Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH seventh reprint2002.
4. Aunuragkumar,D.MAnjunath, Joykuri, "Communication Networking", Morgan Kaufmann Publishers, 1st Edition 2004.
5. Hersent Gurle& petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni," Computer Networking and the Internet" fifth edition, Pearson education
7. Nader F. Mir, Computer and Communication Networks, First Edition.
8. Larryl .Peterson & Bruce S. David, "Computer Networks: A System Approach"-1996

1702CO104	ADVANCED DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand the role of the communication in the design approaches for coding and modulation techniques.
2. To know the trade-offs involved in the design of basic and advanced coding and modulation techniques.
3. To learn the advanced baseband signal conditioning methods evolved for exploiting the channel and user application characteristics
4. To familiarize on modern coding techniquesTo study the types of VPN and tunneling protocols for security.
5. To learn about network security in many layers and network management

UNIT I REVIEW OF ANALOG AND DIGITAL MODULATION TECHNIQUES 9 Hours

Review of PSK, FSK, and ASK, Base band and band pass communication; Signal space representation, Linear and nonlinear modulation techniques, M-ary modulation techniques; Spectral characteristics of digital modulation, Spread spectrum modulation techniques.

UNIT II RECEIVERS FOR AWGN AND FADING CHANNELS 9 Hours

Optimum receivers for AWGN channel -Correlation demodulator, matched filter, maximum likelihood sequence detector, envelope detectors for M-ary signals; Characterization of fading multipath channels, RAKE demodulator, Multiuser detection techniques-Digital transmission over Fading channel.

UNIT III ADVANCED MODULATION TECHNIQUES ANDMULTICARRIER SYSTEMS 9 Hours

Modulation techniques in MIMO system, Cognitive radio modulation technique, OFDM- Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; Peak to Average Power reduction schemes; Multicarrier CDMA- System design, Performance parameters.

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9 Hours

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding

UNIT V TRELLIS CODED MODULATION 9 Hours

Coded modulation for bandwidth-constrained channels-Trellis coded modulation; Set Partitioning, Four –state Trellis-coded modulation with 8-PSK signal constellation, Eight-state Trellis code for coded 8-PSK modulation, Eight-state Trellis for rectangular QAM signal constellations, Decoding methods and implementation issues.

TOTAL: 45 HOURS

FURTHER READING: MODERN CODING TECHNIQUES

Introduction-Turbo Encoder, Turbo Decoder, Iterative Turbo Decoding Principles; Modifications of the MAP Algorithm-The Soft-Output Viterbi Algorithm(SOVA); Turbo Coding for AWGN channels, Turbo Coding for Rayleigh Channels, LDPC Codes, Space time coding and Reed Solomon codes.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: Demonstrate an understanding of the trade-offs involved in the design of basic and advanced coding and modulation techniques and the advanced baseband signal conditioning methods evolved for exploiting the channel and user application characteristics.

CO2: Demonstrate an understanding of the trade-offs involved in the design of basic and advanced coding and modulation techniques and the advanced baseband signal conditioning methods evolved for exploiting the channel and user application characteristics.

CO3: Analyze the user requirements and the type of channel over which the system has to function.

CO4: Apply the knowledge for designing the baseband signaling waveforms that would address the channel impairments. Examine advanced networking techniques

REFERENCES:

1. Bernard Sklar., Digital Communications„, second edition, Pearson Education, 2001.
2. John G. Proakis.,Digital Communication„, 4 th edition, McGraw Hill Publication, 2001
3. Richard Van Nee & Ramjee Prasad.,OFDM for Multimedia Communications„ Artech House Publication, 2001.
4. Theodore S.Rappaport., _Wireless Communications„, 2nd edition, Pearson Education, 2002.
5. Heinrich Meyer, Mare Moene clacy, Stefan .A.Fechtel, " Digital communication receivers ", Vol I &Vol II, John Wiley, New York, 1997.
6. Sergio Verdu, ―Multiuser Detection‖, Cambridge University Press, 1998.
7. Andrea Goldsmith , ―Wireless Communication ―, Cambridge Univ. Press, 2006

1702CO105	WIRELESS COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To learn the concepts of wireless communication.
2. To know about the various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication

UNIT I WIRELESS CHANNEL PROPAGATION AND MODEL 9 Hours

Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering-free space, two ray. Small scale fading- channel classification- channel models – COST -231 Hata model, Longley-Rice Model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading –shadowing Distributions, Link power budget Analysis.

UNIT II CAPACITY OF WIRELESS CHANNELS 9 Hours

Capacity in AWGN, capacity of flat fading channel, capacity of frequency selective fading channels.

UNIT III DIVERSITY 9 Hours

Realization of independent fading paths, Receiver Diversity: selection combining, Threshold Combining, Maximum-ratio Combining, Equal gain Combining. Transmitter Diversity: Channel known at transmitter, channel unknown at the transmitter

UNIT IV MIMO COMMUNICATIONS 9 Hours

Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain: Beam forming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC,STTC, Spatial Multiplexing and BLAST Architectures.

UNIT V MULTI USER SYSTEMS 9 Hours

Review of Multiple Access Techniques, Scheduling, power control, Uplink and Downlink channel capacity, multiuser diversity, MIMO-MU systems.

TOTAL: 45 HOURS

FURTHER READING:

Non-regenerative MIMO wireless relays, Finite state Markov model of correlated Rician-fading channels, Fractionally Spaced Equalizer Passband Equalization -Optimum Digital Detector in Additive Gaussian Noise Detection of binary data using spectrum estimation techniques.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Analyze the state of art techniques in wireless communication.
CO2 Describe MIMO Communications
CO3 Review multiple access techniques

REFERENCES:

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.
2. Harry R. Anderson, ―Fixed Broadband Wireless System Design‖ John Wiley – India, 2003.
3. Education 2009.
4. Andreas.F. Molisch, ―Wireless Communications‖, John Wiley – India, 2006.
5. Simon Haykin& Michael Moher, ―Modern Wireless Communications‖, Pearson Education,
6. 2007.
7. Rappaport. T.S., ―Wireless communications‖, Pearson Education, 2003.
8. Gordon L. Stuber, ―Principles of Mobile Communication‖, Springer International Ltd., 2001.
9. UpenaDalal, ―Wireless Communication ― Oxford Higher

1704CO106	SIGNAL PROCESSING AND COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

1. To understand underlying concepts in signal, speech and image processing
2. To provide a comprehensive analysis of digital modulation techniques.
3. To learn about the adaptive filtering algorithms.
4. To understand the mechanism of multi rate systems, source control coding, error control coding and OFDM.

LIST OF EXPERIMENTS:

1. Implementation of LMS, RLS adaptive filters to remove noise to the estimation of Channel.
2. Implementation of Digital Modulation Techniques
3. Compare Gaussian minimum shift keying (GMSK) and minimum shift keying (MSK) modulation schemes
4. Simulation of Linear, Convolutional and Cyclic Codes
5. Design and simulation of Multirate systems
6. Design and Analysis of spectrum estimators (Barlett,Welch)
7. Simulation and analysis of speech and image compression algorithms
8. Design and implementation of source coding technique
9. Implementation of Pulse Coded Modulation using Simulink
10. Implementation of OFDM physical link using Simulink

MINI PROJECT:

- Signal enhancement using spectral subtraction
- Image denoising
- Audio compression
- Adaptive Echo/Noise canceller
- Radar Tracking System
- GSM

TOTAL: 30 HOURS

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: 1. Able to learn about signal processing concepts and to implement the adaptive filtering algorithms

CO2: 2. Able to understand the image and speech processing algorithms

CO3: 3. Able to analyze the various modulation, coding techniques and multirate systems

1704CO107	WIRELESS COMMUNICATION NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

1. To study the network simulators for implementation of different layered protocols
2. To Implement MAC and Routing algorithms
3. To perform simulation and analysis of various network protocols, Mobility model

LIST OF EXPERIMENTS:

1. Design and Implementation of wired network in open source simulator and performance analysis
2. Simulation of Distance Vector and Link state routing in NS2
3. Simulation of a multicast routing mechanism in NS2
4. Simulation and Performance analysis of IEEE 802.11 networks based on Throughput, PDR, Average End to End delay and Jitter
5. Simulation of IEEE 802.11 networks with Mobility and performance comparison based on Throughput, PDR, Average End to End Delay and Jitter
6. Simulation and Performance analysis of IEEE 802.16 WiMAX networks
7. Design and Simulation of Handover mechanism in WiMAX systems and performance analysis based on Packets sent and received
8. Simulation and Performance analysis of Table Driven routing protocol in Mobile Ad Hoc Networks
9. Simulation of On-Demand Routing Protocols in Mobile Adhoc networks and Performance comparison with Table Driven Protocols
10. Simulation of a security attack in Wireless Networks and analysis of performance degradation
11. Performance analysis of secure routing mechanism in Wireless Networks and study on network performance in the presence of an attack
12. Design and simulation of Wireless Sensor Networks using Zigbee and performance analysis based on battery model

MINI PROJECT

1. Design of Vehicular Ad Hoc Network and performance analysis based on different Mobility conditions
2. Design of Wireless sensor networks for a specific application of Patient Health Monitoring
3. Performance analysis and comparison of Battery aware models in Wireless Networks
4. Performance evaluation of Medium Access Control in Heterogeneous wireless networks
5. Design and simulation of GSM network and their performance analysis

TOTAL: 30 HOURS

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Able to analyze characteristics of analog and digital channels in a communication systems
CO2 Able to understand wireless medium access mechanisms
CO3 Able to analyze and test performance of routing protocols
CO4 Able to analyze IP and TCP traffic in static and mobile adhoc network

1704CO108	COMMUNICATION SKILLS LAB I (Common to all M.E Progarmmes)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To acquire skills for using English in workplace effectively.
2. To communicate for essential business needs.
3. To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment

LIST OF EXPERIMENTS:

1. GRAMMAR AND VOCABULARY

Forming asking complex questions – expressing purpose and function –modal verbs – impersonal passive voice– Reported speech – cause and effect – relative pronouns – expressions followed by – *ing* forms– acronyms – marketing terms / vocabulary – financial terms – collocations – discourse markers

2. LISTENING

Purposes of listening – features of listening texts – potential barriers to listening – specific listening skills – strategies to use when listening– distinguishing relevant from irrelevant information – gap filling exercise – multiple-choice options – note completion – matching and multiple choice questions – listening for specific information, gist, topic, context and function.

3. SPEAKING

Word and sentence stress – clear individual sounds – turn taking – initiating and responding - intonation patterns – pronunciation – mother tongue intrusion– conversation practice – turn-taking and sustaining the interaction by initiating and responding appropriately- Public Speech – Lectures.

4. READING

Purposes of reading – potential barriers to reading – paraphrasing – identifying facts and ideas – skimming and scanning for information – matching statements with texts– spotting reference words – understanding text structure – understanding the ideas in a text – distinguishing between the correct answer and the distracter – understanding cohesion in a text – deciphering contextual meaning of words and phrases – cloze – proof reading - transcoding.

5. WRITING

Paragraphing a text – using appropriate connectives – editing practice –Longer Documents: writing a proposal & Reports, Agenda – Minutes – Circular

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS:

1. Body Language: Kinesics, Proxemics, Para linguistic, Nuances of Speech Delivery
2. Personality Development: Building self esteem
3. Team work

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: To enable students to get International recognition for work and study.

CO2: To use English confidently in the International business environments.

CO3: To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations

REFERENCES:

1. Guy Brook-Hart, "BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student"s Book", 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.
3. Swets, Paul. W. 1983. The Art of Talking So That People Will Listen: Getting
4. The Process of Writing: Planning and Research, Writing, Drafting and Revising