MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : CO

Programme Name : M.E. - COMMUNICATION SYSTEMS

Regulation : R-2016

MUTHAYAMMAL ENGINEERING COLLEGE

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(Approved by AICTE, Accredited by NAAC & NBA, Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

Ph. No.: 04287-220837

Email: principal@mec.edu.in.

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

INSTITUTION VISION &MISSION

INSTITUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards

INSTITUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTITUTION MOTTO

Rural upliftment through Technical Education

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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To empower the electronics and communication engineering students on basics and advanced technologies in both theoretical and experimental practices with research attitude and ethics

DEPARTMENT MISSION

- To impart need based education in electronics and communication engineering to meet the requirements of academic, industry and society
- To establish the state-of-art laboratories to prepare the students for facing the challenges ahead
- To prepare the students for employment, higher education and research oriented activities

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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

PROGRAM EDUCATIONAL OBJECTIVES

The Electronics and Communication Engineering Graduates should be able to

PEO1: Pursue as an engineer with necessary conceptual, analytical and theoretical knowledge in the domain of electronics and communication engineering

PEO2: Acquire the practical knowledge through basics and advanced laboratories in the field of electronics and communication engineering

PEO3: Demonstrate the leadership skills through entrepreneurship, employment and higher studies and to practice ethical values for the benefit of society and environment

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/Development solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Design and analyze electronic circuits and systems for various applications

PSO2: Apply the acquired knowledge and analytical skills for modeling and simulation of advanced communication systems

PSO3: Ascertain the use of software and hardware tools for developing variety of electronics and communication systems

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Estd. 2000

M.E. – COMMUNICATION SYSTEMS

GROUPING OF COURSES

Foundation Courses (FC) :

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16MSA01	Advanced Numerical Methods	FC	5	3	2	0	4
2.	16MSA02	Applied Mathematics	FC	5	3	2	0	4
3.	16MSA03	Applied Probability and Statistics	FC	5	3	2	0	4

Professional Core (PC) :

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16MSB01	Radiation Systems	PC	5	3	2	0	4
2.	16MSB02	Information Theory and Coding	PC	3	3	0	0	3
3.	16MSB03	Statistical Signal Processing	PC	3	3	0	0	3
4.	16MSB04	Optical Communication Networks	PC	3	3	0	0	3
5.	16MSB05	Mobile Communication Networks	PC	3	3	0	0	3
6.	16MSB06	Modern Digital Communication Techniques	PC	5	3	2	0	4
7.	16MSB07	RF System Design	PC	3	3	0	0	3
8.	16MSB08	Electromagnetic Interference and Compatibility	PC	3	3	0	0	3
9.	16MSB09	Microwave Integrated Circuits	PC	3	3	0	0	3
10.	16MSB10	Communication Network Design	PC	3	3	0	0	3
11.	16MSB11	Wireless Networks	PC	3	3	0	0	3
12.	16MSB12	DSP Processor Architecture and Programming	PC	3	3	0	0	3

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13.	16MSB13	Statistical Signal Processing Laboratory	PC	2	0	0	2	1
14.	16MSB14	RF System Design Laboratory	PC	2	0	0	2	1

Professional Electives (PE):

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16MSC01	Multimedia and Compression Techniques	PE	3	3	0	0	3
2.	16MSC02	Routing Algorithms	PE	3	3	0	0	3
3.	16MSC03	Adaptive Beam Forming	PE	3	3	0	0	3
4.	16MSC04	Biological Effects of Microwaves	PE	3	3	0	0	3
5.	16MSC05	Soft Computing	PE	3	3	0	0	3
6.	16MSC06	Wireless Security System	PE	3	3	0	0	3
7.	16MSC07	RTOS and its Applications	PE	3	3	0	0	3
8.	16MSC08	Optical Signal Processing in Communication	PE	3	3	0	0	3
9.	16MSC09	High Speed Switching Architecture	PE	3	3	0	0	3
10.	16MSC10	Mobile Adhoc Networks	PE	3	3	0	0	3
11.	16MSC11	RF MEMS	PE	3	3	0	0	3
12.	16MSC12	Satellite Remote Sensing	PE	3	3	0	0	3

Employability Enhancement Courses (EEC):

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16MSD01	Project Work Phase -I	EEC	12	0	0	12	6
2.	16MSD02	Project Work Phase -II	EEC	24	0	0	24	12

Audit Courses (AC) :

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	16MSE01	English for Research Paper Writing	AC	2	2	0	0	0
2.	16MSE02	Disaster Management	AC	2	2	0	0	0
3.	16MSE03	Sanskrit for Technical Knowledge	AC	2	2	0	0	0

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4.	16MSE04	Value Education	AC	2	2	0	0	0
5.	16MSE05	Constitution of India	AC	2	2	0	0	0
6.	16MSE06	Pedagogy Studies	AC	2	2	0	0	0
7.	16MSE07	Stress Management by Yoga	AC	2	2	0	0	0
8.	16MSE08	Personality Development through Life Enlightenment Skills.	AC	2	2	0	0	0

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Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - I

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16MSA02	Applied Mathematics	3	2	0	4	5
2.	16MSB01	Radiation Systems	3	0	0	3	3
3.	16MSB02	Information Theory and Coding	3	0	0	3	3
4.	16MSB03	Statistical signal processing	3	0	2	4	5
5.	16MSB04	Optical Communication Networks	3	0	0	3	3
6.	16MSB05	Mobile Communication Networks	3	0	0	3	3
Total Credits						**20**	

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Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - II

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16MSB06	Modern Digital Communication Techniques	3	2	0	4	5
2.	16MSB07	RF System Design	3	0	2	4	5
3.	16MSB08	Electromagnetic Interference and Compatibility	3	0	0	3	3
4.	16MSC01	Multimedia and Compression Techniques**(Elective I)**	3	0	0	3	3
5.	16MSC08	Optical Signal Processing in Communication **(Elective II)**	3	0	0	3	3
6.	16MSC06	Wireless Security System**(Elective III)**	3	0	0	3	3
Total Credits						**20**	

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Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - III

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	16MSC09	High Speed Switching Architecture **(Elective IV)**	3	0	0	3	3
2.	16MSC10	Mobile Adhoc Networks**(Elective V)**	3	0	0	3	3
3.	16MSC12	Satellite Remote Sensing**(Elective VI)**	3	0	0	3	3
Practical							
4.	16MSD01	Project Work Phase -I	0	0	12	6	12
Total Credits						**15**	

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SEMESTER - IV

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
Practical							
1.	16MSD02	Project Work Phase -II	0	0	24	12	24
Total Credits						**12**	

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16MSA02 **APPLIED MATHEMATICS** **L T P C**
3 2 0 4

COURSE OBJECTIVES:

- To realize the use of matrix theory techniques in engineering applications and to develop for future applications.
- To analyze and solve the fundamental problem with prescribed or free boundary conditions in simple cases
- Demonstrate knowledge of mathematics and mechanics to construct, analyze and interpret real world problems
- Provide a foundation and motivation for exposure to statistical ideas subsequent to the course.
- To formulate and construct a mathematical model for a linear programming problem in real life situation
- To introduce Fourier series analysis which is central to many applications in engineering

COURSE OUTCOMES:

- Explain geometrical concepts related to orthogonality and least squares solutions and perform calculations related to orthogonality.
- The variation calculus makes access to mastering in a wide rangeof classical results of variationalcalculus. Students get up apply results in technical problem solutions
- The students will have a basic knowledge of the main fields of mathematics and mechanics, including differential equations, elasticity theory, fluid mechanics.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable
- The knowledge gained on this course helps the students to do engineering optimization.
- Demonstrate an understanding of the basic concepts of Fourier series analysis

UNIT –I :MATRIX THEORY 9+6

The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT – II :CALCULUS OF VARIATIONS 9+6

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionalsdependant on functions of several independent variables – Variational problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

UNIT – III: ONE DIMENSIONAL RANDOM VARIABLES 9+6

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT – IV: LINEAR PROGRAMMING 9+6

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

UNIT – V: FOURIER SERIES AND EIGEN VALUE PROBLEMS 9+6

Fourier Trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function: cosine and sine series – Non-periodic function: Extension to other intervals - Power signals: Exponential Fourier

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series – Parseval's theorem and power spectrum – Eigen value problems and orthogonal functions – Regular Sturm-Liouville systems – Generalized Fourier series.

TOTAL: 45 + 30 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mital.K.V. Mohan and Chander	Optimization Methods in Operations Research and Systems Analysis, 4th Edition	New Age International Publishers	2016
2.	Stark. H., and Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014
3.	HamdyATaha	Operations Research, 9th Edition (Asia)	Pearson Education, Asia	2014
4.	Gupta, A.S.	Calculus of Variations with Applications	Prentice Hall of India Pvt. Ltd., New Delhi	2011
5.	Richard Bronson	Matrix Operation, Schaum's outline series, 2nd Edition	McGraw Hill	2011

WEB URLs

1. http://nptel.ac.in/courses/111108066/ http://www.cs.utexas.edu/~pingali/CS378/2011sp/lectures/chol4.pdf
2. http://www.math.uni-leipzig.de/~miersemann/variabook.pdf
3. http://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
4. http://nptel.ac.in/courses/111104027/
5. http://nptel.ac.in/courses/111106046/

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16MSB01 **RADIATION SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the relation between the fields and antenna Fundamentals.
- To understand the of study aperture antennas.
- To introduce the basics of Microstrip and Patch Antennas .
- To design Array antennas
- To know the design of special Antennas
- To know how to measure antenna Parameters

COURSE OUTCOMES:

- Learn to understand the relation between the fields and antenna Fundamentals.
- Learn to understand the of study aperture antennas.
- Learn to introduce the basics of Microstrip and Patch Antennas .
- Learn to design Array antennas
- Learn to know the design of special Antennas
- Learn to know how to measure antenna Parameters

UNIT I :ANTENNA FUNDAMENTALS 9
Antenna fundamental parameter-half wave dipole, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

UNIT II: APERTURE ANTENNAS 9
Huygens' Principle- Radiation Equation- Directivity- Rectangular Aperture- TE10-Mode- CircularAperture- TE11-Mode- Design Considerations- Fourier Transforms in Aperture Antenna Theory. E-Plane Sectoral Horn- H-Plane Sectoral Horn- Pyramidal Horn- Conical Horn –applications.

UNIT III :ANALYSIS AND DESIGN OF MICROSTRIP 9
Configurations- Excitations and radiation mechanism of microstrip patch antennas- Radiation resistance- Power and input impendence. Modeling of rectangular and circular microstrip patch antennas - Transmission line model and cavity model method. Circular polarization and bandwidth ofmicrostrip patch antennas. Simulation of microstrip antennas using Simulation Software-Case studies.

UNIT IV :ARRAY ANTENNAS 9
Linear array and Planar array- Characteristics, synthesis techniques – Fourier Transform method, andTaylor Line Source synthesis and Dolph-Chebyshev distributions.,binomial Arrays, Circular array antennas.

UNIT V :SPECIAL ARRAY ANTENNAS AND ITS APPLICATIONS 9
Conformal and Phased array antennas- sequential rotation and phasing, reactive loading. Arrayantenna measurement- Impedance, coupling, radiation pattern, scan element pattern, Gain Directivity, EIRP.Smart Antennas.

TOTAL: 45Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C.A Balanis.,	Antenna Theory	Wiley	Edition 4 2016
2.	Robert J. Mailloux	Phased Array Antenna Hanbook	Artech House	Edition 2 2005

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3.	HubRegtJ. Visser	Array and Phased Array Antenna Basics	John Wiley and Sons	2005.
4.	DebatoshGuha, Yahia M.M. Antar	Microstrip and Printed Antennas: New Trends, Techniques and Applications	Wiley	2013
5.	J.R James and P.S Hall	Handbook of Microstrip Antennas	Peter peregrinus	1989

WEB URLs:

1. *www.cv.nrao.edu/course/astr534/PDFnewfiles/AntennaTheory.pdf*
2. *www.ece.mcmaster.ca/faculty/nikolova/antenna_dload/current.../L18_Horns.pdf*
3. *anteny.jeziorski.info/wp-content/uploads/2011/10/2011_Alsager.pdf*
4. *https://www.ece.nus.edu.sg/stfpage/.../Lecture%20Notes%5CAntenna%20Arrays.pdf*
5. *drdo.gov.in/drdo/pub/dss/2009/main/13-ARDE.pdf*

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16MSB02 INFORMATION THEORY AND CODING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To get started in practice of Information Theory
- To provide idea of Channels and channel capacity
- To have a complete understanding of source coding
- To understand encoding and decoding of digital data streams
- To understand the practical implementation of Error control coding, Convolution code
- To know the applications of Coding Techniques.

COURSE OUTCOMES:

- To focus on the application of Information Theory to communications in general and on channel coding and capacity in particular.
- To focus basics of discrete channel.
- Analysis of various source coding and channel coding techniques.
- Able to design encoding and decoding of digital data.
- To analyze Various error Detection and Correction Codes
- Able to understand the practical implementation issues, such as Error control coding, Convolution code

UNIT I :INFORMATION THEORY 9

Concept of amount of information -units, Entropy -marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

UNIT II : DISCRETE CHANNELS 9

Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, Repetition of symbols, Binary unsymmetrical channel, and Shannon theorem. Continuous channels –Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Tradeoff between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

UNIT III : SOURCE CODING 9

Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes,Kraft's inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes –Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding.

UNIT IV :ERROR DETECTION AND CORRECTION 9

Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. Cyclic codes –Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

UNIT V :CONVOLUTIONAL CODES 9

Encoding-State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterbi algorithm, Sequential decoding -Stack algorithm. Interleaving techniques –Block and convolutional interleaving, Error Control and Signal Space Coding.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Simon Haykin	Communication Systems	5th Edition , Wiley	2009
2.	Taub& Schilling,	Principles of Communication Systems,	2ndEditionTata McGraw-Hill	2007
3.	R Bose	Information Theory, Coding and Cryptography	TMH	2007
4.	RezaF.M.	AnIntroductionto Information Theory	McGrawHill,New,Delhi	2002
5.	KR.Rao,ZSBojkovic,DAMilovanovic	Multimedia Communication Systems:Techniques Standards and Networks	Pearson Education	2007

WEB URLs:

1. nptel.ac.in/courses/IIT-MADRAS/Principles_Of.../Lecture35-37_SourceCoding.pdf
2. www.tutorialspoint.com/computer_logical_organization/error_codes.htm
3. http://www.unilim.fr/pages_perso/vahid/codage/ch3_capacity.pdf
4. http://nptel.ac.in/courses/117101053/
5. *nptel.ac.in/courses/117106031/*

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16MSB03 STATISTICAL SIGNAL PROCESSING

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- To explore the concepts of multi rate signal processing .
- To study multi rate filters
- To learn Linear Estimation and Prediction.
- To study the adaptive filters and its applications.
- To learn fundamental concepts on signal processing in power spectrum estimation.
- To learn the application of Multirate Signal Processing

COURSE OUTCOMES:

- Able to design and implement decimator and interpolator.
- Able to design multi rate filter bank and acquires knowledge of how a multi rate system work
- Understanding different spectral estimation techniques and linear prediction.
- Ability to design LMS and RLS adaptive filters for signal enhancement, channel equalization.
- Able to understand fundamental concepts on signal processing in power spectrum estimation.
- Able to learn the application of Multirate Signal Processing

UNIT I :MULTIRATE SIGNAL PROCESSING 9

Introduction-Sampling and Signal Reconstruction-Sampling rate conversion – Decimation by an integer factor interpolation byan 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: MULTIRATE FIR FILTER DESIGN 9

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

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: ADAPTIVE FILTERS 9

FIR Adaptive filters - Newton's steepest descent method – Adaptive filters based on steepest descent method -LMS Adaptive algorithm – other LMS based adaptive filters- RLS Adaptive filters - Exponentially weighted RLS - Sliding window RLS – Simplified IIR LMS Adaptive filter.

UNIT V :POWER SPECTRAL ESTIMATION 9

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 Hours

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LIST OF EXPERIMENTS:

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

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	H.Monson Hayes	Statistical Digital Signal Processing and Modeling	John Wiley and Sons, Inc	2008.
2.	G.. John Proakis and G. DimitrisManolakis	Digital Signal Processing	Pearson Education	2006.
3.	P.P.Vaidyanathan	MultirateSyatems and Filter Banks	Pearson Education	2008.
4.	N.J.Filege	Multirate Digital Signal Processing	John Wiley and Sons	2000.
5.	A.Anandkumar	Digital Signal Processing	PHI	2013

WEB URLs:

1. nptel.ac.in/courses/108105059/12
2. https://www.youtube.com/watch?v=z3d1yByn1m4
3. textofvideo.nptel.iitm.ac.in/108105055/lec34.pdf
4. nptel.ac.in/courses/117103018/30
5. https://www.lsv.uni-saarland.de/fileadmin/teaching/dsp/ss15/.../ADF_intro.pdf

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16MSB04 OPTICAL COMMUNICATION NETWORKS

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COURSE OBJECTIVES:

- To understand architecture, protocols and applications, of major optical networking technologies.
- To provide an exposure to solve numerical or analytical problems pertaining to the optical networking technologies
- To design WDM Network Elements
- To understand Network and Management
- To develop the necessary background to perform projects involving optical networks.
- To learn the Application of OSN

COURSE OUTCOMES:

- Understanding of various loss mechanisms and Non-Linear effects in optical communication.
- Knowledge of optical components and WDM network elements.
- Discussion about Optical access network architectures
- Comparison of layered architecture of, IP and MPLS over SONET network.
- Awareness of the advantages of Photonic packet switching, the impediments involved and the available techniques like switching, buffering, multiplexing & synchronization.
- Able to learn the Application of OSN

UNIT I : OPTICAL SIGNAL PROPAGATION AND SYSTEM COMPONENTS 9

Propagation in optical fibers – Loss & bandwidth windows, Intermodal dispersion, Optical fiber as waveguide, Chromatic dispersion. , Non-Linear effects; Solitons; Optical Network Components– Couplers, Isolators &Circulators, Multiplexers & Filters, Optical Amplifiers,Switches, Wavelength Converters.

UNIT II : CLIENT LAYERS OF OPTICAL LAYER 9

SONET / SDH-Multiplexing, CAT & LCAS, SONET/SDH Layers, SONET Frame structure,Elements of SONET/SDH infrastructure, Optical Transport Network- Hierarchy, Frame structuremultiplexing, Generic Framing Procedure, Ethernet-Framing structure, switches, IP over WDM routing and forwarding, QoS, MPLS-Labels and forwarding, QoS, signaling and routing,. Carrier transport, resilient packet ring, storage area networks.

UNIT III : WDM NETWORK ELEMENTS AND DESIGN 9

WDM Network elements - Optical line terminals, Optical line amplifiers, Optical Add/dropmultiplexers-Architectures, Reconfigurable OADMs,, Optical cross connects, All optical OXCconfigurations. WDM Network Design – Cost Trade-Offs: A detailed ring network example, LTD and RWA problems, dimensioning Wavelength routing networks, Stastical dimensioning Models, Maximum load dimensioning models.

UNIT IV: PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and De-multiplexing, Synchronization,Header processing, Buffering, Burst switching, OTDM Access Networks – Network Architecture Overview, Enhanced HFC, FTTC, PON – Evolution.

UNIT V :NETWORK DESIGN AND MANAGEMENT 9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Opticalamplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations; Control and Management – Network management functions, Optical layer services and interfacing, Layers within optical layer, Multivendor interoperability, Performance and fault management, Configuration Management.

TOTAL: 45 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajiv Ramaswami and Kumar Sivarajan	Optical Networks	A Practical Perspective, Morgan Kaufmann	2010
2.	VivekAlwayn	Optical Network Design and Implementation	Pearson Education	2006.
3.	Hussein T. Mouftab and Pin-Han Ho	Optical Networks	Architecture and Survivability, Kluwer Academic Publishers	2002.
4.	Biswanath Mukherjee	Optical Communication Networks	Tata McGraw Hill	2004
5.	Biswanath Mukherjee	Survivable Optical WDM Networks	Tata McGraw Hill	2005

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16MSB05 MOBILE COMMUNICATION NETWORKS

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COURSE OBJECTIVES:

- To understand the basic cellular system concepts.
- To have an insight into the various propagation models and the multiple access techniques in Mobile communication.
- To Understand the concepts of 2G and 3G Networks
- To understand the various protocols in networks.
- To gain knowledge of the various cellular mobile standards.
- To learn Applications of Mobile Communication

COURSE OUTCOMES:

- Understand the concepts of Cellular, Mobile Radio propagation and multiple access techniques and solve engineering problems.
- Outline the organization of Cellular networks and appreciate the differences with fixed networks
- Infer on the evolution of cellular networks and evaluate 2G and 3G networks
- Analyze the protocols in networks
- Understand the concepts of 4G Networks
- Able to learn Applications of Mobile Communication

UNIT I: CELLULAR CONCEPTS AND SYSTEM DESIGN FUNDAMENTALS 9

Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. Cellular Concepts: Frequency reuse, Channel assignment, Hand off strategies, Interference and system capacity, tracking and grade of service.

UNIT II: MOBILE RADIO PROPAGATION 9

Free space propagation model, reflection, diffraction. scattering, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Small scale Multipath measurements, parameters of Mobile multipath channels, fading and its types.

UNIT III: MODULATION AND MULTIPLE ACCESS TECHNIQUESSEQUENTIALLOGIC 9

Minimum Shift Keying (MSK), Gaussian MSK, Orthogonal Frequency Division Multiplexing, Multiple Access Techniques: TDMA, FDMA, CDMA, SDMA.

UNIT IV: 2G AND 2.5G NETWORKS 9

Evolution of Cellular networks – AMPS, DECT and TETRA. GSM - GSM Network Architecture, Air Interface, Channel Organization, Protocols and signaling, Authentication and security, Routing of a call to Mobile Subscriber, Handover in GSM 2.5G-GPRS Network Architecture, Mobility Management, Location Management and Roaming .

UNIT V :3GNETWORKS AND BEYOND 9

UMTS Network Architecture, UMTS Interfaces, Channels, FDD and TDD, Time Slots, UMTS Network protocol architecture and transport network, Mobility Management, UMTS Handover. Concepts of Wi-Fi and WiMAX, Spectrum allocation for 3G, Wi-Fi, WiMAX, 4G and beyond.

TOTAL: 45 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	ItiSahaMisra,	Wireless Communications and Networks: 3G and Beyond	McGraw Hill Education (India) Pvt Ltd	2013
2.	W.C.Y.Lee,	Wireless And Cellular Telecommunications	Third Edition, McGraw- Hill International	2003
3.	T.S.Rappaport,	Wireless Communications: Principles and Practice	Second Edition, Pearson Education/ Prentice Hall of India	Third Indian Reprint 2003.
4.	T.S.Rappaport and Viswanath	Fundamentals of wireless communication	Cambridge Press	2009
5.	T.G Palanivelu, R.Nakkeeran	Wireless and Mobile Communication	Cambridge University	2005

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2. www.ietf.org/internet-drafts/draft-ietf-manet-aodv-11.txt 19
3. *https://etd.ohiolink.edu/rws_etd/document/get/osu1323224057/inline*
4. *https://accessengineeringlibrary.com/browse/2-5g-mobile-networks-gprs-and-edge*
5. *www.wiley.com › ... › Mobile & Wireless Communications*

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16MSB06 MODERN DIGITAL COMMUNICATION TECHNIQUES

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COURSE OBJECTIVES :

- To have an introduction on different receiver design in the Pulse code modulation scheme.
- To understand basics of detection and estimation theory.
- To Design and analyze optimum detection schemes.
- To Study different estimation schemes such as ML and MMSE estimators.
- To understand the concept of third generation error correction and detection codes.
- To learn the applications of Digital Communication

COURSE OUTCOMES :

- Able to design Analog communication systems
- Able to evaluate fundamental communication system parameters
- Able to design equalizer.
- Able to understand the practical implementation of non-ideal filters.
- Able to detect aliasing and inter symbol-interference (ISI).
- Able tounderstand the concept of third generation error correction and detection codes.

UNIT I:BASEBAND DATA TRANSMISSION 9

Baseband PAM –One Shot Minimum Distance Receiver –Minimum Distance Sequence Detection —M-ary signaling scheme-shaping of the transmitted signal spectrum-Noise in Baseband System -Coherent and Non coherent Technique, Orthogonal Modulation – OFDM modulation and Demodulation –Multidimensional Modulation-Modulation with Memory

UNIT II: BAND-LIMITED CHANNELS 9

Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel Models: Fading Dispersive channel, Time and Frequency Selective, Rayleigh channel, karhunen- Loeve Expansion; Diversity Technique: Space, polarization, path, angle, Time and frequency, Diversity Combining Technique.

UNIT III: EQUALIZATION 9

Optimal Zero-Forcing Equalization- Generalized Equalization Methods- Fractionally SpacedEqualizer –Transversal Filter Equalizer –ISI and Channel Capacity –Constrained –complexityEqualizers – Adaptive Linear Equalizer – Adaptive DFE.

UNIT IV: DETECTION 9

Detection of a Single Real-Valued Symbol- Detection of a Signal Vector –Known Signals in Gausian Noise –ML Sequence Detection with the Viterbi Algorithm – A Posteriori Probability Detection with BCJR- Symbol Error Probability for MLSD – incoherent Detection –Shot Noise Signal with known Intensity. Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection.

UNIT V :FUNDAMENTALS OF ESTIMATION THEORY 9

Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory,Types of Estimation Problems, Properties of Estimators, Bayes Estimation, Minmax Estimation, Maximum-Likelihood Estimation, Comparison of Estimator Parameters

TOTAL: 45 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John R Barry, Edward Lee and David G. Messerschmitt	Digital Communication	Springe	2008.
2.	John G. Proakis	Digital Communications	McGraw –Hill International Edition	2009.
3.	Simon Haykin	Communication Systems,	PHI	2008.
4.	BemardSklar	Digital Communications: Fundamentals and Applications	Prentice Hall	2001.
5.	R.N.Mutagi	Digital Communication: Heory. Techniques and Applications	Oxford,2 edition	2013

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1. www.ece.mcmaster.ca/faculty/reilly/ee3tr4/bband.pdf
2. www.ece.ubc.ca/~elec564/chapter5.pdf
3. www.math.uci.edu/icamp/courses/math77c/demos/hist_eq.pdf
4. https://lear.inrialpes.fr/people/triggs/pubs/Dalal-cvpr05.pdf
5. https://www2.spsc.tugraz.at/www-archive/.../WS04-DSPPrinciples/SarwarPaper.pdf

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16MSB07 RF SYSTEM DESIGN

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COURSE OBJECTIVES:

- To learn RF design and circuit board components
- To understand various impedance transformers and biasing networks
- To acquire knowledge of RF filters and RF synthesizer
- To study the basic RF components
- To study the basic RF mixers and oscillators
- To Learn Applications of RF Circuit

COURSE OUTCOMES:

- Understand of various RF issues
- Analysis of impedance transformation
- Know about active RF component, matching and biasing networks
- Design the concepts of RF filter design and their implementation using software
- Learn the operation of RF oscillators and mixers and their design
- To Learn Applications of RF Circuit

UNIT I: RF ISSUES 9

Importance of RF design, Electromagnetic Spectrum, RF behavior of passive components, Chip Components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.

UNIT II: RF FILTER DESIGN 9

Overview, Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

UNIT III: ACTIVE RF COMPONENTS & APPLICATIONS 9

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks – Impedance matching using discrete components, Microstripline matching networks, Amplifier classes of operation and biasing networks.

UNIT IV:RF AMPLIFIER DESIGNS 9

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband , high power and multistage amplifiers.

UNIT V: OSCILLATORS, MIXERS & APPLICATIONS 9

Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers: Phase Locked Loops; RF directional couplers and hybrid couplers ; Detector and demodulator circuits.

TOTAL: 45 Hours

LIST OF EXPERIMENTS:

1. Measurement of transmission line parameters.
2. S-parameter estimation of Microwave devices.
3. Characteristics of $\lambda/4$ and $\lambda/2$ transmission lines.
4. Channel equalizer design (LMS, RLS)
5. Antenna Radiation Pattern measurement
6. Performance Evaluation of digital modulation schemes
7. OFDM transceiver design
8. Performance evaluation of simulated CDMA System.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Reinhold Ludwig and Powel Bretchko,	RF Circuit Design – Theory and Applications	Pearson Education Asia	First Edition, 2001
2.	Joseph. J. Carr	Secrets of RF Circuit Design	McGraw Hill Publishers	Third Edition, 2000
3.	Mathew M. Radmanesh	Radio Frequency & Microwave Electronics	Pearson Education Asia	Second Edition, 2002
4.	William F. Egan	RF System Design of Transceivers for Wireless Communications	**Gu,**Qizheng	2005
5.	William F. Egan,	Practical RF System Design	Wiley-IEEE Press	April 2003

WEB URLs:

1. *www.radio-electronics.com/info/rf...design/rf-filters/rf-filter-basics-tutorial.php*
2. *nptel.ac.in/courses/117101119*
3. www.ssc.pe.titech.ac.jp/materials/VLSICS03_shortcourse_matsu_homepage.pdf
4. *www.rgcetpdy.ac.in/ECE-2014-15_syllabus.pdf*
5. https://www.youtube.com/watch?v=GDTcvS-o2yk

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16MSB08 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY L T P C 3 0 0 3

COURSE OBJECTIVES:

- To understand the concepts related to Electromagnetic interference in PCBs learn RF design and circuit board components
- To provide solutions for minimizing EMI in PCBs
- To learn EMI standards in the design of PCBs
- To learn various EMI coupling principles, EMI standards and measurements
- To provide knowledge on EMI control techniques and design procedures to make EMI Compatible PCBs
- To learn EMI Environment

COURSE OUTCOMES:

- Analyze Electromagnetic interference effects in PCBs
- Propose solutions for minimizing EMI in PCBs
- Analyze Electromagnetic environment, EMI coupling
- Able to understand the EMI standards and measurement
- Able to design a EMI Control techniques
- Able to learn EMI Environment

UNIT I: EMI ENVIRONMENT 9

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

UNIT II:EMI COUPLING PRINCIPLES 9

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

UNIT III: EMI/EMC STANDARDS AND MEASUREMENTS 9

Civilian standards - FCC,CISPR,IEC,EN,Military standards - MIL STD 461D/462, EMI Test Instruments Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures.

UNIT IV: EMI CONTROL TECHNIQUES 9

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT V : EMC DESIGN OF PCBs 9

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Clayton Paul	Introduction to Electromagnetic Compatibility	Wiley Interscience	2006

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2.	Henry W.Ott	Noise Reduction Techniques in Electronic Systems	John Wiley and Sons,NewYork	1988.
3.	V.P.Kodali	Engineering EMC Principles, Measurements and Technologies	IEEE Press, Newyork	2001
4.	Dr Kenneth L Kaiser	The Electromagnetic Compatibility Handbook	CRC Press	2005
5.	Henry W. Ott,	Electromagnetic Compatibility Engineering	John Wiley & Sons	2009

WEB URLs:

1.https://www.environment.gov.za/projectsprogrammes/emi
2.studyvlsidesign.blogspot.com/2014/10/electromagnetic-interference-and.html
3.shodhganga.inflibnet.ac.in/bitstream/10603/28123/10/11_chapter6.pdf
4.https://www.youtube.com/watch?v=krk4_89em48
5.https://www.svce.ac.in/departments/ece/archives/.../EMI%20EMC%20pt%204.ppt

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16MSC01 MULTIMEDIA AND COMPRESSION TECHNIQUES

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COURSE OBJECTIVES:

- Understand error–control coding
- Understand encoding and decoding of digital data streams
- Be familiar with the methods for the generation of these codes and their decoding techniques
- Be aware of compression and decompression techniques
- Learn the concepts of multimedia communication
- To learn applications of video compression

COURSE OUTCOMES:

- Explain Scalar quantization theory and
- Rate distribution Theory
- Understand different coding techniques
- Describe Contour based compression and Motion estimation techniques
- Learn the concepts of multimedia communication
- Able to learn applications of video compression

UNIT I :INTRODUCTION 9

Special features of Multimedia – Graphics and Image Data Representations Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications Need for Compression Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II: TEXT COMPRESSION 9

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – ShannonFano coding – Dictionary techniques – LZW family algorithms

UNIT III: AUDIO COMPRESSION 9

Audio compression techniques μ Law and A Law companding. Speech compression waveform codes source codes hybrid codes Shorten compressor, Frequency domain and filtering – Basic subband coding – Application to speech coding – G.722 –Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

UNIT IV: IMAGE COMPRESSION 9

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Contour based compression – Transform Coding – JPEG Standard – Subband coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG, JBIG2 Standards

UNIT V: VIDEO COMPRESSION 9

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

TOTAL: 45Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Khalid Sayood	Introduction to Data Compression	Morgan Kauffman Harcourt India	2000

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2.	David Salomon	Data Compression	Springer Verlag New York Inc	2001
3.	Yun Q.Shi. Huifang Sun	Image and Video Compression for Multimedia Engineering Fundamentals, Algorithms & Standards	CRC press	2003
4.	Peter Symes	Digital Video Compression	McGraw Hill Pub	2004
5.	Mark S.Drew, ZeNian Li	Fundamentals of Multimedia	PHI, 1st Edition	2003

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2. http://textofvideo.nptel.iitm.ac.in/106105082/lec37.pdf
3. https://www.cs.princeton.edu/~rs/AlgsDS07/20Compression.pdf
4. http://nptel.ac.in/courses/111104027/
5. http://nptel.ac.in/courses/111106046/

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16MSC08 OPTICAL SIGNAL PROCESSING IN COMMUNICATION

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COURSE OBJECTIVES:

- To learn the basic signal parameters of Optical signal processing.
- To explore the concept of different Spatial Filtering techniques
- To understand the basic operation s of spectral analysis.
- To analyse the power spectrum of various Optic devices
- To study about the design of homodyne and heterodyne spectrum analyzers
- To be known the importance of Optical signal processing in communication.

COURSE OUTCOMES:

- Able to analyse optical signal processing systems using its signal parameters.
- Able to understand the spectral filtering and spatial filtering operations in optics.
- Able to get an idea over operation s of spectral analysis.
- Able to get an idea over acousto-optic devices and its applications
- Able to the design of homodyne and heterodyne spectrum analyzers
- Able to get the knowledge of optical signal processing in communication

UNIT I: BASIC SIGNAL PARAMETERS 9

Characterization, Sample function, geometrical optics, basic laws, refraction by prisms, lens formula, imaging condition, optical invariants, physical optics, Transforms: Fresnel, Fourier, Inverse Fourier and Extended Fourier.

UNIT II: SPECTRAL ANALYSIS 9

Spatial light modulation, spatial light modulators, detection process, system performance process, dynamic range, raster format, spectral analysis.

UNIT III: SPATIAL FILTERING AND FILTERING SYSTEM 9

Types of spatial filters, optical signal processing and filter generation, read out module, orientation and sequential search, applications of optical spatial filter.

UNITIV:ACOUSTO-OPTIC DEVICES AND POWER SPECTRUM ANALYSIS 9

Acousto - optic cells, spatial light modulators , Raman – Nath and Bragg mode, basic spectrum analyzer, aperture weighting, dynamic range and SNR, photo detector, geometric considerations, and radiometer.

UNIT V: HOMODYNE AND HETERODYNE SPECTRUM ANALYSERS 9

Overlapping of waves, photo detector size, and optimum photo detector size for 1D and 2D structure, optical radio, spatial and temporal frequencies, Distributed and local oscillator, Dynamic range comparison of heterodyne and power spectrum analyzers.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	P.K. Das	Optical Signal Processing Fundamentals	Narosa Publishing	2012

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2.	G. Boone	Signal processing wing optics Bradley	Oxford University Press	2005
3.	Vanderlught	Optical Signal Processing	John Wiley & Sons	2005
4.	Mahlke Gunther, and Goessing Peter	Fiber optic cables:Fundamentals, Cable Engineering, System, planning	John Wiley	2001
5.	M. N. Bandyopadhyay	Optical Communication And Networks	PHI Learning Pvt Ltd	2014

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2. www.tutorialspoint.com/computer_logical_organization/error_codes.htm
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4. http://nptel.ac.in/courses/117101053/
5. *.nptel.ac.in/courses/117106031/*

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16MSC06 WIRELESS SECURITY SYSTEM

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COURSE OBJECTIVES:

- To explore variety of attacks and threats and its impact on MAC layer and Network layer
- To study characteristics, vulnerabilities and challenges of ad hoc networks
- To provide solution for covering the security principles and flaws of popular wireless technologies
- To evaluate the performance of secured routing protocols in MANETs.
- To compare the performance of the MAC layer.
- To study Challenges in Routing Security

COURSE OUTCOMES:

- Ability to identify the various attacks and threads of wireless Networks.
- Understand and recognize the architectures, vulnerabilities and challenges of mobile protocols.
- Analyze the solutions for covering the security principles of wireless networks.
- Analyze and design security systems for wireless networks.
- Apply in-depth knowledge of wireless communications principles, systems
- Apply in depth knowledge of networks to the solution of wireless engineering problems.

UNIT I: ATTACKS ON ROUTING PROTOCOLS 9

Vulnerability of MANET to attack -review of AODV and DSR -type of attack -active and passive –internal and external -behavior of malicious node -black hole, DoS, Routing table overflow, Impersonation, Energy consumption, Information Disclosure -Misuse type –Misuse goals –Security flaw in AODV -attack on AODV - wormhole and rushing attack -Performance analysis of AODV in the presence of malicious node.

UNIT I : INTRUSION DETECTION IN WIRELESS 9

Ad Hoc Networks Problem in current IDS techniques -requirements of IDS -classification of IDS –Network and host based - anamoly detection, misuse detection, specification based - intrusion detection in MANETs using distributed IDS and mobile agents -AODV protocol based IDS -Intrusion resistant routing algorithms - Comparison of IDS.

UNIT III: MITIGATING TECHNIQUES FOR ROUTING MISBEHAVIOR 9

Watchdog – Parthrater - Packet leashes and RAP.

UNIT IV: SECURE ROUTING PROTOCOLS 9

Self organized network layer security in MANETs - mechanism to improve authentication and integrity in AODV using hash chain and digital signatures - on demand secure routing protocol resilent to Byzantine failures -ARIADNE, SEAD, SAR, and ARAN.

UNIT V: CHALLENGES IN ROUTING SECURITY 9

Security -Challenges and solutions -Providing Robust and Ubiquitous security support -Adaptive security for multilevel Ad Hoc Network -Denial of service Attack at the MAC layer - Detection and handling of MAC layer Misbehavior. Opportunistic routing to mitigate attacks in MANET-The Security of Vehicular Adhoc Networks-Asymmetric and dynamic encryption for routing security in MANET.

TOTAL: 45 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	C.Siva Ram Murthy and B.S.Manoj	AdHoc Wireless Networks Architectures and Protocols	Prentice Hall PTR	2004
2	Ivan Stojmenović	Handbook of Wireless Networks and Mobile Computing	Wiley	2002
3.	Michael Miller	Wireless Networking Absolute Beginner's Guide	Miller	2013
4.	Hongmei Deng, Wei Li and Dharma P.Agrawal	Routing Security in Wireless Ad Hoc Networks	IEEE Communication Magazine	Oct 2002
5.	Amitabh Mishra	Intrusion Detection in Wireless Ad Hoc Networks	IEEE Wireless Communication	February 2004

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4. nptel.ac.in/courses/117102012/
5. https://www.cs.columbia.edu/~smb/talks/routesec.pdf

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16MSC09 HIGH SPEED SWITCHING ARCHITECTURE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concept of various switching
- To analysis the blocking networks
- To learn about the Queuing networks
- To understand the architecture of internet switches
- To analysis the IP
- To learn about high speed switching network.

COURSE OUTCOMES:

- Gain Knowledge of blocking &non blocking networks based on the switches
- Understand about ATM switches and various switching types
- Get an idea on LAN Routing Technology on networking field.
- Understand the concept IP switching Networks.
- Understand the Packet switching architecture.
- Apply the concepts of switching networks in real time.

UNIT I: NETWORKING 9

Introduction-LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM adaptation layers.

UNIT II: ATM SWITCHING ARCHITECTURE 9

Blocking networks -basic -and-enhanced banyan networks, sorting networks-merge sorting, re-arrangable networks-full-and-partial connection networks, non blocking networks -Recursive network construction, comparison of non-blocking network, Switching with deflection routing -shuffle switch, tandem banyan switch.

UNIT III :QUEUES IN ATM SWITCHES 9

Internal Queuing -Input, output and shared queuing, multiple queuing networks –combined Input, output and shared queuing-performance analysis of Queued switches.

UNIT IV :PACKET SWITCHING ARCHITECTURES 9

Architecture of internet switches and routers-Buffer less and buffered crossbar switches, Multi-stage switching, Optical Packet switching; switching fabric on a chip; Internally buffered Crossbars.

UNIT V: IP SWITCHING & LAN SWITCHING TECHNOLOGY 9

Addressing model, IP Switching types -flow driven and topology driven solutions, IP over ATM address and next hop resolution, multicasting, Ipv6 over ATM. Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs.

TOTAL: 45 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	AchillePattavina	Switching Theory: Architectures and performance in Broadband ATM networks	John Wiley & Sons Ltd	1998
2	Elhanany M. Hamdi	High Performance Packet Switching architectures	Springer Publications.	2007
3	Rainer Handel, Manfred N Huber, Stefan Schroder	ATM Networks: Concepts, Protocols, Applications	3/e, Addison Wesley	1999
4	IrvanPepelnjk, Jim Guichard and Jeff Apcar	MPLS and VPN Architecture	Cisco Press	2003
5	Hu, Xiuwen	Architecture and performance evaluation of high-speed optical and electronic switches	CRC press	2012

WEB URLs:

1. www.springer.com/us/book
2. data.epo.org/.../EP0593609A1-HIGH-SPEED-SWITCHING-ARC
3. www.prnewswire.co.uk/.../kabira-supports-high-speed-volume-switching
4. *www.cs.virginia.edu/~cs757/slidespdf/757-08-switcharchp2.pd*
5. *en.wikipedia.org/wiki/LAN_switching*

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16MSC10 MOBILE ADHOC NETWORKS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

- To study characteristics, vulnerabilities and challenges of ad hoc networks
- To explore issues and challenges in designing MAC and TCP Protocols
- AdHoc networks To understand adaptation of the routing protocols in mobile networks
- To explore issues and challenges variety of attacks and threats over different layer
- To evaluate the performance of MAC, routing protocols in MANETs.
- To learn the importance of Mobile AdHoc networks

COURSE OUTCOMES :

- Ability to identify the various challenges and vulnerabilities in MANET
- Obtain an awareness cyber attacks and threads in mobile networks.
- Understand and recognize the architectures, designing MAC, TCP, IP and security protocols
- Analyze the solutions for covering the security principles of wireless networks.
- Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems
- Apply the concepts in real time mobile networks

UNIT I: WIRELESS LAN, PAN, WAN AND MAN 9

Characteristics of wireless channel - Fundamentals of WLANs - IEEE 802.11 standard - HIPERLAN – WLL - Wireless ATM - IEEE 802.16 standard – HIPERACCESS- AdHoc Wireless Internet.

UNIT II: MAC AND ROUTING PROTOCOLS 9

MAC: Design issues - Goals and classification - Contention–based MAC protocols: MACAW, DPRMA, DPSMA.MAC protocols using directional antenna- Routing protocols: AODV, DSR, ZRP, LAR, CHGSR, FSR and power-aware routing protocols.

UNIT III: TRANSPORT LAYER AND SECURITY 9

Transport layer Protocol: Design issues - Goals and classification - TCP over AdHoc wireless Networks – Security - Security requirements - Issues and challenges in security provisioning - Network security attacks - Security routing.

UNIT IV: ENERGY MANAGEMENT 9

Need - Classification of battery management schemes - Transmission power management schemes - System power management schemes. Wireless Sensor Networks: Architecture - Data dissemination - Date gathering - MAC protocols - Location discovery - Quality of a sensor network.

UNIT V: PERFORMANCE ANALYSIS 9

ABR beaconing - Performance parameters - Route-discovery time - End-to-end delay performance - Communication throughput performance - Packet loss performance - Route reconfiguration/repair time - TCP/IP based applications.

TOTAL: 45 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C.Siva Ram Murthy and B.S.Manoj	AdHoc Wireless Networks: Architectures and protocols	Prentice Hall PTR	2007
2.	C.K.Toh	AdHoc Mobile Wireless Networks: Protocols and Systems	Prentice Hall PTR	2008
3.	Mohammad Ilyas	The Handbook of AdHoc Wireless Networks	CRC press	2002
4.	Charles E. Perkins	AdHoc Networking	Addison – Wesley	2008
5.	Jonathan Loo, Jaime Loret Mauri and Jesus Hamilton Ortiz	Mobile AdHoc Networks: Current status and Future Trends	CRC press	2012

WEB URLs:

1. www.ietf.org/internet-drafts/draft-ietf-manet-dsr-07.txt 21
2. www.ietf.org/internet-drafts/draft-ietf-manet-aodv-11.txt 19
3. *searchsecurity.techtarget.com › SSL and TLS VPN Security › Network security*
4. *https://en.wikipedia.org/wiki/Energy_management*
5. *www.businessdictionary.com/definition/performance-analysis.html*

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16MSC12 **SATELLITE REMOTE SENSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study about the Satellite Data and Remote Sensing
- To study about the acquisition of satellite images
- To understand about the processing methodologies of satellite images
- To analyze and extract information from them, using signal and image processing
- To analyze the Compression of data
- To know the importance of satellite remote sensing.

COURSE OUTCOMES:

- Understanding of remote sensing process and spectral reflectance curve
- Knowledge of preprocessing techniques
- Discussion of satellite image enhancement techniques
- Learn the various data fusion
- Learn the various data compression techniques
- Understanding of Satellite remote sensing in real time applications.

UNIT I: SATELLITE DATA AND REMOTE SENSING 9

Remote sensing process, Radiation principles, Spectral reflectance curve, EMR interactions with-atmosphere-earth surface features. Satellite Image Characteristics, Resolution types, Pre-processing-Geometric Correction, Radiometric Correction.

UNIT II: SATELLITE IMAGE ENHANCEMENT 9

Radiometric Enhancement-Histogram Based Enhancements, Density Slicing, Stretching, Geometric Enhancement-Neighborhood Operations, Template Operation

UNIT III :DATA TRANSFORMATION 9

Spectral Transforms-Multispectral Ratios-Vegetation Indexes, Components, Tasseled- CapComponent, Color-Space Transforms, Spatial Transforms-Convolutions, Fourier Transform, Scalespace Transforms.

UNIT IV: IMAGE ANALYSIS AND DATA FUSION 9

Feature Extraction-Statistical, Structural, Training -Supervised, Unsupervised, Hybrid Training, Feature Space fusion, Spatial domain fusion, Scale space fusion

UNIT V :DATA COMPRESSION 9

Compression by coding, Fractal Compression, Wavelet Compression.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thomas M.Lillesand,RalphW. Kiefer	Remote Sensing And Image Interpretation	Willy India	2007

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2	Robert A.Schowengerdt	Remote Sensing Models & Methods For Image Processing	Prentice Hall PTR	2004
3	Rafael C.Gonzalez,RichardE .Woods	Digital ImageProcessing	Prentice Hall PTR	2007
4	Jian Guo Liu, Philippa J. Mason	Image Processing and GIS for Remote Sensing: Techniques and Applications	Prentice Hall	2006
5	Shane Cloude	Polarisation: Applications in Remote Sensing	Prentice Hall	2007

WEB URLs:

1. nptel.ac.in/courses/105108077/10
2. nptel.ac.in/courses/105108077/module4/lecture16.pdf
3. nptel.ac.in/courses / Webcourse-contents/IIT%20Kharagpur/.../Pdf/Lesson-4.pdf
4. www.nptelvideos.in/2012/12/digital-image-processing.html
5. nptel.ac.in/syllabus/117101001/

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