MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

DEPARTMENT: Electronics and Communication Engineering

M.Tech. Specialization: Wireless and Optical Communications

Semester I

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECT661	Advanced Digital Communication Systems	Core	Theory	3	3	0	0
2	ECT675	Wireless Communications	Core	Theory	3	3	0	0
3	ECT679	Advanced Optical Communication Systems	Core	Theory	3	3	0	0
4	ECT910	Modeling, Optimization & Transforms (RM-II)*	Core	Theory	2	2	0	0
5	ECP669	Communication lab-1	Core	Lab	3	0	0	6
6		Program Elective (PE-1)	Program Elective	Theory	3	3	0	0

Semester II

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECT666	Optical Networks	Core	Theory	3	3	0	0
2	ECP670	Communication lab-2	Core	Lab	2	0	0	2
3	ECP900	Technical Documentation	Program Elective	Lab	1	0	0	2
4		Program Elective (PE-2)	Program Elective	Theory	3	3	0	0
5		Program Elective (PE-3)	Program Elective	Theory	3	3	0	0
6		Program Elective (PE-4)	Program Elective	Theory	3	3	0	0
7		Program Elective (PE-5)	Program Elective	Theory	3	3	0	0

Semester III

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECD679	Dissertation	Core	Lab	6	0	0	12
2	ECD667	Research Project	Core	Lab	4	0	0	8

Semester IV

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECD680	Dissertation	Core	Lab	12	0	0	24

*ECT910: Modeling, Optimization & Transforms (RM-II) is Research Methodology Part B for PhD scholars

Course Structure

Semester	Courses	Total Credits
I	Taught Courses	17
II	Taught Courses	18
III	Dissertation, Research Project	10
IV	Dissertation	12

Total Credits = 57

Credit Distribution

Program Core (Excluding dissertation)	19
Program Elective	16
Open Elective	0
Research Project, Dissertation	22

List of Program Electives (indicative and NOT limited to): [Any other course from M.Tech. (Electronics and Communication Engineering) and selected courses from other M.Tech. streams may also be permitted (by Supervisor with prior intimation to DPGC and Head)]		
ECT655	Optical Codes and Applications	3 (3-0-0)
ECT656	Adaptive Signal Processing	3 (3-0-0)
ECT662	Advanced Digital Signal & Image Processing	3 (3-0-0)
ECT664	Estimation and Detection	3 (3-0-0)
ECT670	Satellite Communication and Radar Engg.	3 (3-0-0)
ECT672	Wireless and Mobile Adhoc Networking	3 (3-0-0)
ECT674	Cryptography	3 (3-0-0)
ECT663	Advanced Error Control Codes	3 (3-0-0)
ECT676	Design of Microstrip Antennas	3 (3-0-0)
ECT678	Design of MIC's & MMIC's	3 (3-0-0)
ECT680	Advanced Mobile Systems	3 (3-0-0)
ECT682	Smart and Phased Array Antenna Design	3 (3-0-0)
ECT684	Advanced topics in Communication	3 (2-0-2)
ECT689	Photonic Switching	3 (3-0-0)
ECT692	Computational Electromagnetics	3 (3-0-0)
ECT686	Photonic Integrated Devices and Systems	3 (3-0-0)
ECT690	Wireless Sensor Networks	3 (3-0-0)
ECT694	Advanced Photonic Devices and Components	3 (3-0-0)
ECT698	Advanced Networking analysis	3 (3-0-0)
ECT696	Telecomm. Technology & management	3 (3-0-0)
ECT657	VLSI signal processing architectures	3 (3-0-0)
	Multirate Signal Processing	3 (3-0-0)
ECT681	Special modules in WOC-I	1(1-0-0)
ECT683	Special modules in WOC-II	1(1-0-0)
ECT685	Special modules in WOC-III	1(1-0-0)
ECT687	Special modules in WOC-IV	1(1-0-0)

DPGC Convener

Head, ECE

SPGB Chairman

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT661**

Course Name : **Advanced Digital Communication Systems**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core

Prerequisites : none

Course Contents

Unit I - Review: Signals and Systems with focus on Random Signals, Sampling Theorem, Signal Space and Constellation Diagrams and Orthogonal Signal Sets. Baseband modulation and Demodulation: Detection of binary signals in Gaussian Noise, ISI, Equalization, Carrier and symbol synchronization, and Signal Design for bandlimited channels. **(no. of lectures- 12)**

Unit II - Bandpass modulation and Demodulation: Modulation Techniques, Coherent and Non Coherent Detection, Error performance for binary system, and Symbol error performance for M-ary systems.

(no. of lectures- 9)

Unit III - Communication link analysis: Link budget analysis, Simple link analysis, system trade-offs, and Modulation coding trade-offs. **(no. of lectures- 8)**

Unit IV - Spread Spectrum: signal PN sequences, DS-CDMA, FH-CDMA, and Jamming consideration. Communication through Fading Channels

(no. of lectures- 7)

COURSE OUTCOMES

CO1. To apply mathematics in the analysis and design of a digital communication system.

CO2. To mathematically analyse the role and effects of noise.

CO3. To study different modulation schemes in terms of error performance and bandwidth requirement.

CO4. To improve the performance of a system using advanced communication techniques.

CO5. To mathematically characterize the effects of the communication link.

Recommended Readings

Text Books:-

1. Sklar, Digital Communications, Pearson
2. Proakis, Digital Communications, TGMH.
3. B.P. Lathi, Modern Digital and Analog Communication, OUP

Reference books:-

1.
2.

Online/E resources:-

1.
2.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT675**

Course Name : **Wireless Communications**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core

Prerequisites : none

Course Contents

WIRELESS CHANNEL PROPAGATION AND MODEL :

Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering-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.

DIVERSITY :

Capacity of flat and frequency selective fading channels-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.

MIMO COMMUNICATIONS:

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

MULTI USER SYSTEMS:

Multiple Access : FDMA,TDMA, CDMA,SDMA, Hybrid techniques, Random Access: ALOHA,SALOHA,CSMA, Scheduling, power control, uplink downlink channel capacity, multiuser diversity, MIMO-MU systems.

WIRELESS NETWORKS:

3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, 4G features and challenges, Technology path, IMS Architecture -

Introduction to wireless LANs -IEEE 802.11 WLANs - Physical Layer- MAC sublayer.

(no. of lectures- 36)

COURSE OUTCOMES

CO1. Appreciate and familiarize the world of Wireless communications.

CO2. Analysis of different type of Diversity in Transmitter/Receiver.

CO3. Comparative Analysis of different Wireless channel models.

CO4. Study of various Multiple Access techniques for multi user system.

Recommended Readings

Text Books:-

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

2. HARRY R. ANDERSON, "Fixed Broadband Wireless System Design" John Wiley – India, 2003.

3. Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.

4. Simon Haykin & Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.

5. Rappaport. T.S., "Wireless communications", Pearson Education, 2003.

6. Clint Smith. P.E., and Daniel Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.

7. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007.

8. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.

9. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.

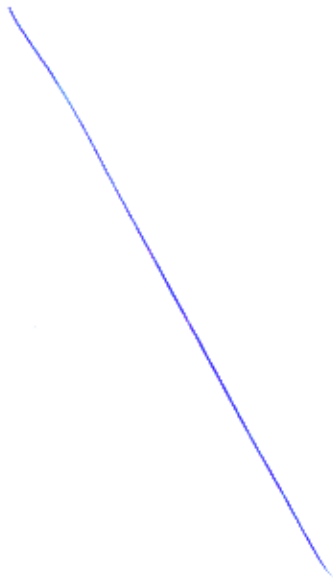
10. Sumit Kasera and Nishit Narang, "3G Networks – Architecture, Protocols and Procedures", Tata McGraw Hill, 2007.

Reference books:-

1.
2.

Online/E resources:-

1.



MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT679**

Course Name : **Advanced Optical Communication Systems**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core

Prerequisites : none

Course Contents

Review of optical fiber waveguiding concepts, Advanced fiber design: Dispersion issues,
Dispersion shifted, Dispersion flattened, Dispersion compensating fiber, Design optimization of single mode fibres. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication.

Transmitter design, Receiver - PIN and APD based designs, noise sensitivity and degradation. Receiver amplifier design. Transceivers for fiber optic communication pre amplifier type- optical receiver performance calculation - noise effect on system performance receiver modules.

Coherent, homodyne and heterodyne keying formats, BER in synchronous- and asynchronous- receivers, sensitivity degradation, system performance, Multichannel, WDM, multiple access networks, WDM Components, TDM, Subcarrier and Code division multiplexing. Semiconductor laser amplifiers, Raman - and Brillouin - fiber amplifiers, Erbium doped fiber amplifiers, pumping phenomenon, LAN and cascaded in-line amplifiers. Limitations, Post- and Pre-compensation techniques, Equalizing filters, fiber based gratings, Broad band compression.
Next Generation Optical Communications: Multi-core MMF based SDM transmission, Optical wireless communications.

(Total no. of lectures- 36)

COURSE OUTCOMES

CO1. Develop understanding of design concepts related to optical including dispersion and its compensation, GVD, Dispersion shifted, Dispersion flattened and Dispersion compensating fibers, non-linear effects.
CO2. Design Optical Communication systems including power and rise time budget analysis, component selection, Transmitters, Receivers and amplifiers and evaluate their performance.
CO3. Analyze different modulation schemes along with their system performance, various detection schemes.

CO4. Appreciate Multichannel and multiplexing techniques such as WDM and DWDM.
CO5. Evaluate the performance of optical communication systems under high power conditions including non-linear effects, FWM.

Recommended Readings

Text Books:-

1. Fiber-Optic Communication Systems by Govind P. Agrawal
2. Franz and Jain, "Optical communication systems", Narosa Publications, New Delhi, 1995

Online/E resources:-

1. Online Resource: https://nptel.ac.in/courses/117101002/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT-910

Course Name : Modeling, Optimization & Transforms

Credits : 2 L- 2 T- 0 P- 0

Course Type : Core

Prerequisites : none

Course Contents

[The following contents intend to cover implicit application to and exemplification through ECE problems in signal processing, probabilistic signal theory, optimization and soft-computing]

Unit I- Advancements in Transforms: Discrete Fourier Transform, FFT, Short time Fourier Transform (STFT), Multi Resolution Analysis, Wavelet Transform, Continuous Wavelet Transform (CWT), Inverse CWT, Discrete Wavelet Transform, Sub-band coding and implementation of DWT, Applications (signal and image compression, de-noising, detection of discontinuous and breakdown points in signals), Discrete Cosine Transform, Stockwell-transform, Frequency selective filtering with wavelet and S-transform.
(no. of lectures- 6)

Unit II- Modelling: Direct Modeling (identification), Inverse Modeling (Equalization), Classification and Clustering, Prediction/Forecasting, Auto regressive models (AR, MA, ARMA).
(no. of lectures- 6)

Unit III- Optimization: Problem formulation, Linear Programming Problems, Solution by Graphical Methods, Symmetric Dual Problems, Slack and Surplus Variables, Simplex Method, Convex- Concave Problems.
(no. of lectures- 6)

Unit IV- Data Mining Techniques: Higher Order Statistics, Principal Component Analysis, Linear Discriminant Analysis, Independent Component Analysis
(no. of lectures- 6)

COURSE OUTCOMES

CO1: To learn the advancement in transforms
CO2: To understand the mathematical modeling and optimization techniques.
CO3: To learn the data mining techniques
CO4: To explore the engineering applications of the mathematical techniques.

CO5: To develop MATLAB and other programming skills for the mathematical techniques realization.

Recommended Readings

Text Books:-

1. Digital Signal Processing: Principles, Algorithms, and Applications 4 Edition, Author: John G. Proakis, Dimitris G Manolakis Publisher: Pearson.
2. Wavelets and Signal Processing, Author: Hans-Georg Stark, Publisher: Springer
3. Stockwell, Robert Glenn, Lalu Mansinha, and R. P. Lowe. "Localization of the complex spectrum: the S transform." IEEE Transactions on Signal Processing 44.4 (1996): 998-1001.

Reference books:-

1. Engineering Optimization: Theory and Practice, Third Edition SINGIRESU S. RAO, New Age Publishers
2. Data Mining - Concepts and Techniques, Authors : Jain Pei, Jiawei Han, Micheline Kamber, Publisher : Elsevier

Online/E resources:-

1. The Wavelet Tutorial : The Engineer's Ultimate Guide to Wavelet Analysis, Author : Robi Polikar, University of Rowan : Online : http://users.rowan.edu/~polikar/WTtutorial.html

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECP669**

Course Name : **Communication Lab-I**

Credits : 2 L- 0 T- 0 P- 2

Course Type : Core

Prerequisites : none

Course Contents

Course will deal with relevant experiments of communication engineering.

(no. of labs- 12)

COURSE OUTCOMES

CO1- Able to understand basic theories of waves and communication system in practical.

CO2- Able to design and implement different modulation and demodulation techniques

Recommended Readings

1. Communication Lab Manual

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT666**

Course Name : **Optical Networks**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I - Optical Networking: Introduction to circuit switching and packet switching, optical layer, network evolution. Optical networking components/building blocks: Optical fibers, Optical transmitter, receiver and filters, multiplexers, switching elements, wavelength converter, and optical amplifiers. Client layers of the optical layer, WDM network elements. **(no. of lectures-10)**

Unit II - Optical networks: Basic networks- SONET/ SDH, Fault management, wavelength routed networks, Nonlinear effects on network performance, performance of various systems (WDM DWDM + SOA), Evaluation of crosstalk and dynamics in reconfigurable networks due to power transients and test countermeasures, Technologies (CWDM, PON, ROADM, RSOA) and topologies of access, aggregation and distribution networks
(no. of lectures- 14)

Unit III - Optical Access Network: Access networks, Photonic packet switching. Deployment considerations. Overview of PON technologies, Ethernet access network, WDM-PON, HFC Systems (Standards: CATV, VDSL), 10-Gigabit Ethernet (xGbE) (Standards: IEEE 802.3.aq), Microwave Photonics and Radio-over-Fiber (RoF) (Standards: IEEE 802.11a/16b, 3GPP UTRAN etc) including schemes for RF-over-Fiber systems carrying wireless formats such as WiFi, WiMax, UMTS, LTE, PON and FTTH (Standards: ITU G 983 & G 984 and IEEE 802.3. ah), Control and management, network survivability, protection schemes
(no. of lectures- 12)

COURSE OUTCOMES

CO1. Appreciate optical switching, network evolution and components
CO2. Evaluate performance of optical networks with non-linear effects
CO3. Implement optical access networks and recent developments

Recommended Readings

Text Books:-

1. R. Ramaswami & K. N. Sivarajan, Optical Networks (3/e), Elsevier.
2. C. Sivaramamurthy & M. Gurusamy, WDM Optical Networks, PHI.

Reference books:-

1.

Online/E resources:-

1.
2.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : **Department of Electronics and Communication Engineering**

Course Code : **ECP670**

Course Name : **Communication Lab-II**

Credits : 2 L - 0 T - 0 P - 2
Course Type : Core / Elective
Prerequisites : none

Course Contents

Course will deal with relevant experiments to advance communication

(no. of labs- 12)

COURSE OUTCOMES

CO1- Able to understand practically advance techniques in communication system.
CO2- Able to conduct various experiments of different types of communication technology

Recommended Readings

1. Communication Lab Manual

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : **Department of Electronics and Communication Engineering**

Course Code : **ECP900**

Course Name : **Technical Documentation**

Credits : 1 **L** - 0 **T** - 0 **P** - 2

Course Type : Core / Elective

Prerequisites : none

Course Contents

Introduction: Literature survey – Understanding journal metrics (impact factor, number of citations, h-index, i10 index), Identifying high impact articles, Problem identification, Ethics of publishing.
(2 hours)

Document Formatting: Advantages of LaTeX, Installation, Package manager, Editors, Typesetting, Classes – Book, Thesis, Article, Slide, Poster, Parts of a document - Chapters, Sections, Items, Fonts, Acronyms, Author kits, Debugging.
8 hours

Figures, Tables, and Equations: Figures, Subfigures, Tables, Types of tables, Spacing in tables, Captions, Equations, Equation arrays, Equation numbering, Labels.8 hours

Referring articles: Using labels, Citing articles, Bibliography, Bibtex, Styles, Mendeley, JabRef.
(4 hours)

Artwork: Drawing with LaTeX, Flowcharts in LaTeX, Creating plots with Gnuplot/ Octave/ Matlab, Creating scalable vector graphics with Inkscape, Tikz.
(4 hours)

Reformatting documents, Responding to reviewer comments, Reviewing technical documents.
(2 hours)

COURSE OUTCOMES

CO1. Identify high impact literature, understand the importance of ethical publishing

CO2. Use LaTeX to compile technical documents containing quality figures, tables, and equations.
CO3. Use bibtex for automatic referencing.
CO4. Create quality graphics.
CO5. Understand the process of responding to reviewer comments, and reviewing technical documents.

Recommended Readings

1. **World wide web**

2. **Text Books:-**

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : **Department of Electronics and Communication Engineering**

Course Code : **ECT655**

Course Name : **Optical Codes and Applications**

Credits : 3 L - 3 T - 0 P - 0
Course Type : Core / Elective
Prerequisites : none

Course Contents

Introduction: Historical Perspective of Optical Communications, Optical Transmission and Optical Networking, Optical Communications Trends, Migration to 100 Gb/s Ethernet and Beyond. **(no. of lectures- 9)**

Optical Coding Schemes: Unipolar and Bipolar codes, 1D time spread codes, phase encoding, spectral amplitude coding, 2D phase-wavelength, wavelength-time and space-time codes, spectral amplitude coding and 3D space-wavelength-time, polarization-wavelength-time and space-wavelength-phase codes.

(no. of lectures- 9)

Performance Metrics for comparison of codes: Cardinality, Code dimension, Correlation functions, BER due to multiple access interference, received power & noise.

(no. of lectures- 9)

Enabling Hardware Technologies: Optical encoders/decoders using fiber optic components & integrated optics, Optical AND gate as a decoder, Realization of Optical logic gates, Potential Applications, Latest topics in optical codes and applications

(no. of lectures- 9)

COURSE OUTCOMES

CO1. Is able to grasp historical perspective and recent trends of Optical Communications including Networking.
CO2. Is able to construct and analyze 1D, 2D and 3D codes.
CO3. Is able to design Optical encoders/decoders using fiber optic components & integrated optic technologies.
CO4. Is able to search and review latest topics.

Recommended Readings

Text Books:-

1. Optical code division multiple access: Fundamentals and Applications - Paul R. Prucnal (CRC Press)
2. Optical coding theory with prime - Wing C. Kwong; Guu-Chang Yang (CRC Press)
3. Spreading codes for all-optical code division multiple access communication systems – M. Ravi Kumar (Ph.D. Thesis, IIT Kharagpur)

Reference books:-

1. Design and Performance Analysis of a New Family of Wavelength/Time Codes for Fiber-Optic CDMA Networks - E. S. Shivaleela (Ph.D. Thesis, IISc Bangalore)

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT662**

Course Name : **Advanced Digital Signal & Image Processing**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Introduction to Multirate systems and filter banks, 2D systems and mathematical preliminaries, Digital Representation of Binary & Gray Scale and colour Images, Linear operations on images.

Image sampling and quantization: 2D Sampling on rectangular and nonrectangular sampling lattice, Aliasing, Lloyd-Max quantizer etc.

Image Transforms: 2D Discrete Fourier transform, DCT, DST and Hadamard ,Harr K-L Transforms & their applications to image processing.

Image restoration:Wiener filtering , smoothing splines and interpolation.

Image Enhancement Techniques: Gray scale transformation, Histogram matching and equalization,

Smoothening:- Noise Removal, Averagins, Median, Min/Max. Filtering sharpening of Images using differentiation, the laplaciam, High Emphasis filtering,

Image analysis: Edge detection, Boundary Lines & Contours.

Image representation by Stochastic models: ARMA models, 2D linear prediction.

Image Segmentation &Thresholding: Multiband Thresholding, Thresholding from Textures, Selective histogram Technique.

Image Compression: Compression Techniques using K-L Transform, Block Truncation Compression. Error free Comprerssion using Huffman coding & Huffman shift coding.

(Total no. of lectures-36)

COURSE OUTCOMES

CO1 : Ability to understand Multirate systems , Image sampling and quantization

CO2 : Ability to understand Image Transforms , Image restoration and Image Enhancement Techniques

CO3 : Ability to understand Image analysis , Image Segmentation & Thresholding, Image Compression

Recommended Readings

Text Books:-

1. Digital Signal Processing- Oppenheim A.V. & Schafer R.W. PHI.
2. Digital Signal Processing-by Mitra- (TATA McGraw Hill) Publications.
3. Digital Image Processing- by Gonzalez / Woods, (Pearson Education)

Reference books:-

1. Digital Image Processing- by A.K. Jain
2. Digital Picture Processing- by Rosenfield & Kak

Online/E resources:-

1. https://nptel.ac.in/courses/117/105/117105135/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT664**

Course Name : **Estimation and Detection**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I: Classical Detection Theory: Decision Theory; Binary Decisions, Gaussian Noise; Detection in Gaussian Noise; **(no. of lectures- 7)**

Unit II: Representation for Signals; Solution of the Integral Equations; Decisions among a Number of Known Signals, Performance Bounds and Approximations, Detection in Non-white Gaussian Noise **(no. of lectures- 8)**

Unit III: Estimation of Parameters and Random Processes: The theory of estimation; Bayes estimation; Estimation of (Non-random) signal parameter; Multiple parameter estimation, Estimation Bounds, ML estimation via Expectation-Maximization algorithm,

(no. of lectures- 11)

Unit IV: Regularization Joint Estimation and Detection: Composite Hypotheses, Linear Estimation, Elements of Modern estimation and detection theory (as the time permits).

(no. of lectures- 10)

COURSE OUTCOMES

CO1. Master the fundamentals of estimation and detection theory.
CO2. Analyse the performance bounds of various detection schemes.
CO3. Master the estimation schemes using advanced techniques.
CO4. Analyse the strengths and shortcomings of existing estimation and detection techniques.
CO5. Study the state of the art in the estimation and detection.

Recommended Readings

Text Books:-

1. H. L. Van Trees, Detection, Estimation, and Modulation Theory, vol. 1, Wiley Interscience, 2001.
2. C. W. Helstrom, Elements of Signal Detection and Estimation, Prentice Hall, 1995.
3. H. V. Poor, An Introduction to Signal Detection and Estimation, Springer, New York, 1994.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT670**

Course Name : **Satellite Communication and Radar Engg.**

Credits : 3 L - 3 T - 0 P - 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I- : Introduction to satellite communication and different types of orbits; orbital mechanics and parameters **(no. of lectures- 5)**

Unit II- Satellite subsystems, space link design **(no. of lectures- 4)**

Unit II- Multiplexing and access techniques for satellite communication; introduction to spread spectrum; Global navigation satellite systems (GNSS) **(no. of lectures- 9)**

Unit IV- Internet and satellite links; very small aperture antenna; special purpose satellites **(no. of lectures- 8)**

Unit V- Fundamentals of radar systems, Radar modalities, basic operating principles (detection, ranging, Doppler, importance of phase), radar system components **(no. of lectures- 10)**

COURSE OUTCOMES

CO1 : Understand the basic principles of satellite communication.
CO2 : Design the satellite link to fulfil various power requirements Techniques
CO3 : Discuss the multiplexing and multiple access techniques used in satellite and navigation systems.
CO4: Discuss special satellites and their subsystems.
CO5: Explain the basics of radar

Recommended Readings

Text Books:-

1. Introduction to Radar Systems: Merrill I. Skolnik, McGraw-Hill
2. Satellite communication systems, B. G. Evans, Published by IET
3. Satellite Communication, P. Banerjee, PHI

Online/E resources:-

1. https://nptel.ac.in/courses/117/105/117105131/
2. https://nptel.ac.in/courses/108/105/108105154/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT674**

Course Name : **Cryptography**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I : Cryptography: Basic Terms and Concepts, Brief History of Cryptography and Cryptanalysis. **(no. of lectures – 4)**

Unit II : Uses and misuses. Basic Number Theory - Divisibility, Primarily, Bases, Congruence's, Modular Arithmetic, GCD'S, Euclidian algorithm, Fermat and Euler Theorems, Finding large primes, Pohlig-Hellman, RSA. **(no. of lectures – 6)**

Unit III : Elementary and Historical Ciphers - Caesar cipher, Transposition and Substitution, Poly- alphabetic ciphers, Product ciphers, DES, IDEA and Exponentiation ciphers. Cipher Modes - Block ciphers, Stream ciphers, Public vs. Private keys, Meet-in-the-middle, LFSRS.
(no. of lectures – 8)

Unit IV : Authentication methods - One-way ciphers, Authentication functions, Message digests, MDS, SHA, Tripwire, Kerberos. Privacy-enhanced communication - Privacy, non-repudiation, Digital signatures, Certificate hierarchies, X.509, PGP, PKI. Introduction to secure transaction standards. **(no. of lectures – 9)**

Unit V : Key Management - Threshold schemes, Random number generation, Key escrow, Key recovery. Applications - Mental Poker, Quadratic residues, Oblivious transfer and Zerknowledge proofs. Digital cash, Digital voting and Contract signing
(no. of lectures – 9)

COURSE OUTCOMES

CO1. Understand the basics of Cryptography
CO2. Apply number theory concepts to study basic cryptographic algorithms
CO3. Differentiate various algorithms in terms of confidentiality, integrity and authenticity.
CO4. Understand the strengths and weaknesses of various ciphers.

CO5. Apply the concepts learnt to real world scenarios.

Recommended Readings

Text Books:-

1. Williain Stallings "Cryptography and Network Security: Principles and Practice", Pearson Education, 2000.
2. KernalTexpalan, "Communication network Management:, PHI, 1992.
3. D.E. Cormer," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.

Reference books:-

1. Sharma, Vakul, "Handbook of cyber Laws", Macmillan India Ltd, 2002.

Online/E resources:-

1. https://nptel.ac.in/courses/106/105/106105162/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT678**

Course Name : **Design of MIC's & MMIC's**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Review of fundamentals of electronic conduction in compound semiconductors. Study of semiconductors like GaAs, InP. Fundamentals of band gap engineering. New materials and their growth techniques.

Dielectric material and their properties, thick film and thin film techniques, loss tangent, effective dielectric constant. Effect of dielectric height, metal thickness, width and freq. on dielectric constant.

Two and three terminal devices for MIC and MMIC applications. Study of MESFET and

HEMT performance analysis and biasing arrangements. Review of planar transmission lines, their applications as distributed components. Device and circuit integration techniques, multi-layered structures, probing and coupling techniques, bonding techniques.

CAD for MIC and MMIC, Intr. to nonlinear analysis, synthesis and optimization. Application of foundry design rules, models and design rule checks, layout techniques, process tolerances.

Methods of measurements and testing of MIC and MMIC. Intr. to scalar and network measurements, full nonlinear, harmonic and noise characterization.

Applications of MIC and MMIC as, passive components, switches, mixers, oscillators, amplifiers. Intro. to Quasi-optical systems.

(Total no. of lectures - 36)

COURSE OUTCOMES

CO1. Understand the fundamentals of the electric conduction in different semiconductors.

CO2. Identify the appropriate dielectric material for the design of MIC and MMIC.

CO3. Apply transmission lines concept to understand the working of MIC and MMICs.
CO4. Design MIC and MMICs using non-linear synthesis and optimization techniques.
CO5. Characterize the designed MIC and MMIC using advanced measurement techniques.

Recommended Readings

Text Books:-

1. Microwave Material and fabrication techniques by Laverghetta, Artech House
2. Microstrip Line and Slot Lines, KC Gupta, R garg, I Bahl, P Bhartia, Artech House
3. Computer Aided Analysis of Nonlinear Microwave Circuits, Paulo JC Rodrigues, Artech House

Reference books:-

1. The RF and Microwave Circuit Design Cookbook, SA Mass, Artech House

Online/E resources:-

1. https://nptel.ac.in/courses/117/101/117101119/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT682

Course Name : Smart and Phased Array Antenna Design

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I: Review of Antenna Theory, Analysis and Design, Introduction, Smart Antenna analogy, Signal Propagation, Strengths and Shortcomings, Beamforming, Mobile Adhoc Networks, Design, Simulation and Results.
(no. of lectures -10)

Unit II: Phased Arrays in Radar and Communication Systems: System requirements for radar and communication antennas, Array characterization for radar and communication systems, Fundamental results from array theory, Array size determination, Time-delay compression.
(no. of lectures -12)

Unit III: Pattern characteristics of Linear and Planar Arrays: Array analysis, characteristics of linear and planer arrays, Scanning to endfire, Thinned arrays. Pattern Synthesis for Linear and Planar Arrays: Linear arrays and planar arrays with separable distributions, circular planar arrays and adaptive arrays. Electronic Scanning Radar Systems: Frequency and phase scanning, Phase design techniques.
(no. of lectures- 14)

COURSE OUTCOMES

CO1: Understand and review the basics of the antenna design.
CO2: Understand the working principles of Smart antennas.
CO3: Analyse the phased array antenna systems.
CO4: Synthesize the radiation pattern of phased array antennas.
CO5: Understand the fundamentals of electronic scanning radar systems.

Recommended Readings

Text Books:-

1. Frank Gross, Smart antennas for wireless communications, McGraw-Hill, 2006.
2. R. J. Mailloux, Phased array antenna handbook, Artech house, 2005.
3. R.C. Hansen, Phased Array Antennas, Wiley, 1997.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT672

Course Name : Wireless and Mobile Adhoc Networking

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Wireless Communication Standards, Characterization of the Wireless Channel, Receiver
Techniques for Fading Dispersive Channels, Mobility Management in Wireless Networks, Mobile IP, Mobile Ad hoc Networks, Ad hoc Routing Protocols, Performance Analysis of DSR and CBRP, Cluster Techniques, Incremental Cluster Maintenance Scheme, Space time Coding for Wireless Communication. **(no. of lectures- 36)**

COURSE OUTCOMES

CO1: To understand the wireless communication standards and characterization of the Wireless Channels.
CO2: To analyze the Mobility Management in Wireless Networks, Mobile IP, Ad hoc routing protocols.
CO3: To understand the Performance Analysis of DSR and CBRP.
CO4: To analyze the Clustering Techniques and Incremental Cluster Maintenance Scheme.

Recommended Readings

Text Books:-

1. Wireless Communication and Networking by John W. Mark, WeihuaZhuang.
2. Wireless Adhoc Networks by M. Ilyas, CRC Press

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT676**

Course Name : **Design of Microstrip Antennas**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I - Review: Signals and Systems with focus on Random Signals, Sampling Theorem, Signal Space and Constellation Diagrams and Orthogonal Signal Sets. Baseband modulation and Demodulation: Detection of binary signals in Gaussian Noise, ISI, Equalization, Carrier and symbol synchronization, and Signal Design for bandlimited channels. **(no. of lectures- 12)**

Unit II - Bandpass modulation and Demodulation: Modulation Techniques, Coherent and Non Coherent Detection, Error performance for binary system, and Symbol error performance for M-ary systems.

(no. of lectures- 9)

Unit III - Communication link analysis: Link budget analysis, Simple link analysis, system trade-offs, and Modulation coding trade-offs. **(no. of lectures- 8)**

Unit IV - Spread Spectrum: signal PN sequences, DS-CDMA, FH-CDMA, and Jamming consideration. Communication through Fading Channels

(no. of lectures- 7)

COURSE OUTCOMES

CO1. To apply mathematics in the analysis and design of a digital communication system.

CO2. To mathematically analyse the role and effects of noise.

CO3. To study different modulation schemes in terms of error performance and bandwidth requirement.

CO4. To improve the performance of a system using advanced communication techniques.

CO5. To mathematically characterize the effects of the communication link.

Recommended Readings

Text Books:-

1. Micro strip Antenna Design Handbook by Ramesh Garg, Prakash Bhartia, Inder Bahl,
   Apisak Ittipiboon. Artech House.
2. Handbook of Antennas in Wireless Communication by Lal Chand Godara,CRC Press.

3. CAD of Micro strip Antenna for Wireless Applications by Robert A. Sainati, Artech
House.
4. Compact and Broadband Micro strip Antenna by Kin-Lu Wong, John Wiley & Sons.
5. Micro strip Patch Antennas by Robert B. Waterhouse, Kluwer academic Publishers.
6. Handbook of Micro strip Antennas by J.R. James and P.S. Hall, Peter Peregrinus Ltd.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT680**

Course Name : **Advanced Mobile Systems**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Introduction: Components of Mobile Communication systems, Operation of cellular system, Trunking Efficiency, Concept of Frequency reuse, Multipath propagation, Short term and Long term fading, Frequency selective fading, Signal Propagation Models. Co-Channel Interference, Techniques for reducing Co-Channel Interference, Diversity Techniques, Other Interferences-Adjacent Channel Interference, Near End Far End Interference, Cross talk, Interference between systems, Hand off Techniques, Antennas for Base Station and Mobile Units

Analog cellular Mobile System: Channel structures, RF power level, Modulation, Spectrum & channel Designation, Network control activity, System operation , Principal functions, Mobile scanning, registration, Call origination, Call receipt, Handoff, call termination, security & Identification, Supervisory Audio Tone (SAT) Signalling Tone (ST), Signalling Format.

Digital Cellular Mobile Systems: Digital v/s Analog cellular systems, Modulation, ARQ Technique, Digital Speech coding, Digital Mobile Telephony, channel Equalization,

Multiple Access Schemes- FDMA, TDMA, CDMA.

Introduction to Analog &Digial MARR, WLL system, 3-G Systems, Mobile Computing.

Example systems: AMPS, MATS-D, CD-900, GSM **(no. of lectures- 36)**

COURSE OUTCOMES

CO1: Appreciate Components of Mobile Communication systems and Operation of cellular system.
CO2: Analyse Interference and Techniques for reducing Co-Channel Interference.
CO3: Evaluate Analog cellular Mobile Systems for Channel structures.
CO4: Design Digital Cellular Mobile Systems, compare the performance of Digital and Analog cellular systems.
CO5: Learn OFDM, OFDMA, MIMO, Cognitive radio systems.
CO6: Introduction to 3G-UMTS, 4G-LTE and 5G Mobile Communication systems.

Recommended Readings

Text Books:-

1. Mobile & Cellular Telecommunication by W.C.Y Lee. McGrawhill
2. Wireless Communications by T. S Rappaport, IEEE Press
3. Wireless & Mobile Communication Systems by D.P Agarwal& Qing Anzen, Thomson Press

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT684

Course Name : Advanced topics in Communication

Credits : 3 L - 3 T - 0 P - 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Advanced topics in: Multiuser Detection Techniques, Wireless Networking, Optical Networking, Signal Processing, Mobile Communication, Computer Networking, and their applications. **(Total no. of lectures - 36)**

COURSE OUTCOMES

CO1: Review the fundamentals of communication technologies.
CO2: Apply the advanced communication topics to real world examples.
CO3: Master the state of the art techniques in the area of communication technologies.
CO4: Apply the mathematics to analyse and design the advanced communication system.
CO5: Develop an ability to read a scientific literature in the advanced communication technologies.

Recommended Readings

Text Books:-

1. William Stallings, "Wireless Communications & Networks", ISBN: 0131918354, Prentice Hall; 2nd edition, November 12, 2004.
2. Mobile & Cellular Telecommunication by W.C.Y Lee. McGraw-Hill
3. Digital Signal Processing- Oppenheim A.V. & Schafer R.W. PHI.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT686**

Course Name : **Photonic Integrated Devices and Systems**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I: Planar waveguides: Step-index and graded-index waveguides, guided and radiation modes. Strip and channel waveguides, anisotropic waveguides, segmented waveguide; electro-optic and acousto-optic waveguide devices. Directional couplers, optical switch; phase and amplitude modulators, filters, etc. Y-junction, power splitters, Arrayed waveguide devices, fiber pig tailing, Fabrication of integrated optical waveguides and devices. Waveguide characterization, end-fire and prism coupling; grating and tapered couplers, nonlinear effects in integrated optical waveguides.

(no. of lectures- 14)

Unit II: New materials and process technologies for optical device fabrication, advanced optical sources & detectors, amplifiers, their reliability issues, Polymer waveguides, Surface Plasmon Devices, Optical integrated circuits, hybrid & monolithic systems, optical interconnects, materials and processing for OEIC.

(no. of lectures- 12)

COURSE OUTCOMES

CO1. Develop understanding of design concepts related to optical planar waveguides, directional couplers and switches.
CO2. Analyze and Design components such as WDM couplers, filters, isolators, circulators, photonic crystal based waveguides.
CO3. Explore new materials and process technologies for optical device fabrication, reliability issues.
CO4. Develop understanding of design concepts related to hybrid and monolithic systems, optical interconnects.

Recommended Readings

Text Books:-

1. Integrated Optics, by Robert G. Hunsperger, Springer
2. Integrated Photonics: Fundamentals, By Ginés Lifante, John Wiley and Sons

Online/E resources:-

1. https://nptel.ac.in/courses/117/108/117108142/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT689

Course Name : Photonic Switching

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit –I: Introduction to Photonic Switching: All Optical Switches, Comparison of OEO and OOO switches, Parameters used for switch performance evaluation, applications of optical Switches, optical cross-connects, protection and restoration, optical Add/Drop multiplexing, optical signal monitoring, etc.
(no. of lectures - 10)

Unit –II: Switch Types & Structures: Optical Switch Fabrics, Opto-mechanical Switches, Optical Micro Electro-Mechanical Systems (Optical MEMS), Electro-Optic Switches, Thermo-Optic Switches, Liquid-Crystal Switches, Bubble Switches. Acousto-Optic Switches, Semiconductor Optical Amplifier Switches, grated switches and photonic crystal fibre based switches, etc.
(no. of lectures - 9)

Unit –III: Switch Architectures: Introduction to various architectures & algorithms for building large switches, Cross, Clos, Banyan architecture, Benes architecture, Spanke architecture, Spanke- Benes architecture, etc. **(no. of lectures - 8)**

Unit –III: Switching in Optical Networks, Opaque Switching, Challenges for Optical Switching, Optical Switching Paradigms, nano photonic switches. **(no. of lectures - 9)**

COURSE OUTCOMES

CO1: Appreciate and evaluate all optical switches
CO2: Design various types of optical switches
CO3: Understand different switch architectures
CO4: Implementation of optical switches in optical networks

Recommended Readings

Text Books:-

1. Optical Switching by G.I Papadimitriou, C. Papazoglon and A.S Pomportsis, Wiley series in microwave & optical Engg.
2. Optical components for communications by Ching-Fuh Lin, Kluwer academic publishers.
3. Photonics by Ralf Menzel, Springer International Edition.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT690**

Course Name : **Wireless Sensor Networks**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Network architecture, wireless communication: the physical layer in WSN, WSN medium access control and link layer protocols, WSN services: synchronization and localization, topology control and routing, data-centric and content-based routing, Quality of Service and transport protocols, in-network aggregation and WSN security

(Total no. of lectures-36)

COURSE OUTCOMES

CO1: Master the fundamentals of wireless sensor network.
CO2: Understand the protocols and their design considerations.
CO3: Model and simulate different WSN parameters.
CO4: Understand the parameters to estimate the QoS.
CO5: Master key routing protocols and the associated design challenges.

Recommended Readings

Text Books:-

1. Murthy &Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols," ISBN 0-13147023-X, Pearson 2004
2. William Stallings, "Wireless Communications & Networks", ISBN: 0131918354, Prentice Hall; 2nd edition, November 12, 2004.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT692**

Course Name : **Computational Electromagnetics**

Credits : 3 L- 0 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I: Review of Electromagnetic Theory, Classification of EM Problems.

Unit II: Analytical Methods-Separation of Variables.

Unit III: Finite Difference Methods. Variation Methods.

Unit IV: Method of Moments. Finite element Method.

(Total no. of lectures- 36)

COURSE OUTCOMES

CO1: Apply numerical methods in understanding electrostatics and high frequency electromagnetics.
CO2: Evaluate the numerical solution in terms of validity and accuracy.
CO3: Assess the limitations and applicability of the discussed numerical methods.
CO4: Understand the default parameters for efficient usage of commercial solvers.
CO5: Explore independently the scientific literature for state of the art techniques.

Recommended Readings

Text Books:-

1. Numerical Techniques in Electromagnetics, by Matthew N.O. Sadiku, CRC Press.
2. Theory and Computation of Electromagnetic Fields by Jianming Jin, Wiley.

Online/E resources:-

1. https://nptel.ac.in/courses/108/106/108106152/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT694**

Course Name : **Advanced Photonic Devices and Components**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Components for Fiber optic Networks- Couplers/Splitters- -semiconductor optical amplifier- bandwidth of SOPA- Polarization dependant gain noise-erbium doped fiber amplifiers- WD multiplexers / demultiplexers- Filters- isolator- circulators- Optical switches-wavelength converters- Fiber gratings-tunable sources, tunable filters.

Photonic crystal structures and devices.

Homo- and hetero-junctions, quantum wells, advanced semi-conductor materials Semiconductor optical amplifiers, LEDs and LDs: Device structure and Characteristics, DFB, DBR, and quantum well lasers, VCSELS & Laser diode arrays.

Computer aided design of integrated optical waveguide devices. Application of photonics to microwave devices. Nonlinear optical waveguides.

Engineering of DWDM systems. ITU standards and nomenclature, channel capacity, bit rate and modulation, network topologies, current performance and future research issues.

(Total no. of lectures-36)

COURSE OUTCOMES

CO1:Develop understanding of design concepts related to photonic devices and components used in all-optical communication systems.

CO2:Analyze and Design components such as WDM couplers, filters, isolators, circulators, photonic crystal based waveguides.

CO3:Analyze advanced concepts in design of homo and hetero junction devices, quantum well structures, DFB/DBR lasers.

CO4:Appreciate the comparative selection of devices for particular applications such as dispersion compensation, switching, multiplexing/demultiplexing, including AWG, diffraction gratings, Bragg gratings.

Recommended Readings

Text Books:-

1. Fiber Optic Communication systems, G.P.Aggarwal,Wiley Eastern
2.Introduction to Fiber Optics , A.Ghatak and K.Thyagrajan, Cambridge Univ. Press
3. Introduction to Optical Electronics, K.A. Jones, Harper & Row

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT696

Course Name : Telecomm. Technology & management

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I: Introduction to existing telecommunication technologies GSM, WLL, CDMA, Circuit, packet, frame relay and ATM switching, Broadband ISDN, Evolution of IS-95 and third generation systems,
(no. of lectures- 14)

Unit II: Microcell networks planning in CDMA, Indoor planning, Sectorization and smart antenna, Tariff rules and guidelines, Comparison of different wireless technologies.

(no. of lectures- 12)

COURSE OUTCOMES

CO1: Apply different multiplexing techniques to share network bandwidth
CO2: Identify the design challenged related to indoor communication technologies.
CO3: Understand the role of smart antennas in modern communication technologies.
CO4: Design the efficient strategies for Tariff rules and Guidelines.
CO5: Identify the appropriate network planning strategy for a given design problem.

Recommended Readings

Text Books:-

1. W. Stalling, Data Comm. & Networking

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT698

Course Name : Advanced Networking analysis

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Advanced network analysis: Application analysis using the Application form (AAF), Binary-Hex-Decimal conversion, building test packets, Calculating the cost of network problems (Analysis ROI), Key network calculations: Throughput, Latency and Bandwidth, Unattended captures: Triggered starts/stops, Analysis ROI worksheet/calculation.

(Total no. of lectures-36)

COURSE OUTCOMES

CO1: Develop and revise the fundamentals of computer networks.
CO2: Build the test packets for advanced analysis techniques.
CO3: Assess the strengths and weakness of various protocols.
CO4: Identify the challenges in managing and configuring switches and routers.
CO5: Analyse the cost of network problems using ROI worksheets.

Recommended Readings

Text Books:-

1. CCNA Portable Command Guide, Second Edition by Scott Empson
2. Network Analysis by Laura Chappell

Online/E resources:-

1. https://nptel.ac.in/courses/117/105/117105135/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT656**

Course Name : **Adaptive Signal Processing**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Adaptive Filter Structures and Algorithms:

Introduction to Adaptive systems, Adaptive Linear combiner, Minimum Mean-Square Error, Wiener-Hopf Equation, Error Performance Surface, LMS algorithm, Convergence of weight vector, Learning Curve, FX-LMS algorithm (Filtered X-LMS) and its application to ANC, Types of LMS, RLS algorithm, Matrix Inverse Lemma for RLS, Computational complexity of LMS and RLS, Convergence Analysis.

IIR-LMS, Lattice Filter, FIR to Lattice conversion and vice-versa, Adaptive Lattice Filter Kalman Filter, Adaptive Kalman Filter

Transformed domain adaptive filtering : Block Linear, Block Circular Filter Banks and multi-rate signal processing

Distributed signal Processing : Incremental LMS, Diffusion LMS

Applications:

Direct Modelling or System Identification, Inverse Adaptive Modelling (Equalization), Adaptive Noise Cancellation, Adaptive filters for time series and stock market prediction, Biomedical Applications (Cancellation of 50-Hz interference in Electro-Cardiography, Cancelling donor heart interference in heart-transplant electrocardiography, Cancelling Maternal ECG in Fetal Electrocardiography), Echo Cancellation in Long distance Telephone Circuits, Adaptive self tuning filter, Adaptive line enhancer, Adaptive filters for classification and data mining.

(Total no. of lectures-36)

COURSE OUTCOMES

At the end of the course the student will be able to:

CO1 : To learn the characteristics of adaptive system architecture and analyze Wiener-Hopf Equation.

CO2 : To understand the machine learning algorithms including LMS, RLS, Fx-LMS etc.

CO3 : To learn the adaptive structures like : Adaptive Lattice Filter, Kalman Filter, Transformed domain adaptive filtering, Filter Banks.

CO4 : To explore the applications of adaptive signal techniques to System Identification, Channel Equalization, time series prediction etc.
CO5: To develop MATLAB programming skills for adaptive systems.

Recommended Readings

Text Books:- (Title, Authors, Publisher & Year)

1. B. Widrow and S. D. Stearns : Adaptive Signal Processing, Prentice Hall.
2. D. G. Manolakis, V. K. Ingle, S. M. Kogon : Statistical and Adaptive Signal Processing, McGraw Hill.
3. S. S. Haykin : Adaptive Filter Theory, 4th Edition, Prentice Hall.
4. A. H. Sayed : Fundamentals of Adaptive Filtering, John Wiley & Sons.

Online/E resources:-

1. https://nptel.ac.in/courses/117/105/117105075/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT657**

Course Name : **VLSI signal processing architectures**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit 1: **Introduction to VLSI DSP Sytems**

Need of VLSI DSP algorithms. main DSP Blocks and typical DSP Algorithms. Fixed point /Floating point Representation; Floating point Arithmetic Implementation, Architectures of Adders/Multipliers; CORDIC, representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph.

(no. of lectures - 8)

Unit 2: **Iteration Bound**

Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs **(no. of lectures - 5)**

Unit 3: **Pipelining and Parallel Processing:**

Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving **(no. of lectures - 7)**

Unit 4: **Retiming, Unfolding and Folding:**

retiming techniques; algorithm for unfolding, Folding transformation, Techniques of retiming, Unfolding & Folding **(no. of lectures - 5)**

Unit 5: **Systolic Array Architecture**

Systolic Array Architecture: Methodology of systolic array architecture, FIR based Systolic Array, Selection of Scheduling Vector, Matrix multiplication of systolic array

(no. of lectures - 6)

Unit 6: **Low power Design**

Theoretical background , Scaling v/s power consumption, power analysis, Power reduction techniques, Power estimation approach **(no. of lectures- 5)**

COURSE OUTCOMES

At the end of the course the student will be able to:

CO1: To understand Graphical representation of DSP algorithms and Mapping algorithms into Architectures (Cognitive/Skills- Apply)

CO2: To study architecture for real time systems and parallel and pipelining for Low power design (Cognitive- Remembering)

CO3: To be aware of systolic Array architecture and methodology for developing Architectures (Cognitive- Understanding)

CO4: To know different signal processing modules as convolution technique, retiming concept, folding /unfolding Transformation and CORDIC architecture. (Cognitive-Analyze)

CO5: To implement different low power Design techniques. (Skills- evaluate)

Recommended Readings

Text Books:-

1. VLSI Digital Signal Processing System : : Design and implementation by K.K. Parhi
2. Digital Signal Processing with Field Programmable Gate Arrays Uwe Meyer-Baese , Springer.
3. FPGA-based Implementation of Signal Processing Systems. by Roger Woods, John Mcallister, WILEY

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : **Department of Electronics and Communication Engineering**

Course Code : **ECT663**

Course Name : **Advanced Error Control Codes**

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Error Control coding for wireless fading channels, Channel Estimation and Adaptive channel coding, Joint Source and Channel coding . Non binary Linear Block Codes, Hard and soft decision decoding, Coding and Decoding of BCH, Reed Solomon Codes, Convolution codes: Coding and Decoding , Distance bounds, Performance bounds Turbo
codes: Coding, Decoding Algorithms, Performance comparison , Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparison.
LDPC Codes, Polar Codes, Error control codes for : Audio/video transmission, mobile communications, space and satellite communication, data transmission, data storage and file transfer.

(no. of lectures-

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COURSE OUTCOMES

CO1. Appreciate the need of Error Correction in communication systems after going through the course

CO2. Develop requisite mathematical background for Error Correction using linear algebra

CO3. Design error correcting codes using mathematical models

CO4. Design encoders and decoders for a given error correcting capability

CO5. Validate theoretical results with simulation results

CO6. Use MATLAB software for simulation (TT)

Recommended Readings

Text Books:-

1. Stephen G. Wilson; Digital Modulation & Coding;. Prentice Hall Inc.
2. Ranjan Bose; Information Theory Coding and Cryptography, TMH
3 .Blahut R.E. , Theory and practice of error control codes, AWL1983.
4. J.G.Proakis; Digital Communication.

Online/E resources:-

1. https://nptel.ac.in/courses/117/108/117108044/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : NA

Course Name : Multirate Signal Processing

Credits : 3 L- 3 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Unit I- Introduction to Multirate Signal Processing; Overview of Sampling and Reconstruction, Review Discrete-Time Systems, Digital filters, FIR and IIR Filter, Oversampling techniques, DT processing of continuous time signals.

(no. of lectures-8)

Unit II- Fundamentals Blocks of Multirate Systems, Basic building blocks – Up sampling, Down sampling, Aliasing, Interference, Reconstruction, Sampling Rate Change and filtering, Fractional sampling rate alteration, Different Applications.

(no. of lectures-7)

Unit III- Interconnection of Multirate DSP blocks, Multiplexer and De-multiplexer functionality, Polyphase decomposition, Noble Identities, Efficient implementation of sampling rate conversion, Classification of Realization Techniques, Direct Form Realization.

(no. of lectures-7)

Unit IV- Classification of Filterbank, Two channel maximally decimated filter bank, Signal impairments - Aliasing, Magnitude distortion, Phase distortion, *M*-Channel Filterbank, Uniform Filterbank, Non-Uniform Filterbank, Perfect reconstruction Filterbank, Aliasing cancellation, Tree Structure, Parallel Structure, Modulation based Methods.

(no. of lectures- 8)

Unit V- Applications of Multirate DSP - DFT-based Filterbank, Interpolated FIR filter design, Delta Sigma A/D conversion, Transmultiplexers Design, Recent Advancement in Multirate System.

(no. of lectures- 6)

COURSE OUTCOMES

"Outcome of this subject will be very beneficial to PG Students. During the last few decades, Multirate System has found numerous Application in various domain of

Engineering such as Subband Coding of Speech Signals, Compression of audio/Video/Image Signals, Transmultiplexers and in ECG/EEG Signals Analysis. At the end of the course of study, individual will be able to demonstrate following skills which would be evaluated though various assessments:

- Analysis of Recent Signal Processing Techniques and Algorithms in Filterbank Systems
- Design FIR filters for multi rate signal processing, Appreciate Components of Multirate System
- Design PR and NPR Filterbank and Transmultiplexers Systems
- Characteristics of Multirate systems
- Evaluate sampling rate conversions and learn different Applications

Recommended Readings

Text Books:-

1. Vaidyanathan, Parishwad P., "Multirate systems and filter banks", Pearson Education India, 2006
2. Rabiner, Lawrence R., "Multirate digital signal processing", Prentice Hall PTR, 1996

Reference books:-

1. 1. N.J. Fliege, "Multirate digital signal processing", John Wiley 1994
2. S. K. Mitra and Y. Kuo, " Digital signal processing: a computer-based approach", McGraw-Hill, 2006.

Online/E resources:-

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://onlinecourses.nptel.ac.in/noc19_ee50/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT681**

Course Name : **Special Modules in WOC – 1**

Credits : 1 L- 1 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Current advances in Wireless and Optical Communications as defined by instructor-Following is suggested but not restrictive:

- Optical devices and relevant materials
- Optical Sensors
- Optoelectronics
- Nanophotonics **(Total no. of lectures-12)**

COURSE OUTCOMES

CO1: To analyze & design devices used in optical communications (simulation/fabrication).

CO2: To enable her/him to perform research problem solution in a niche & socially relevant area

Recommended Readings

1. Current literature from quality journals & magazines such as IEEE, IET etc. & others;
2. Books on niche areas;

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT683**

Course Name : **Special Modules in WOC – 2**

Credits : 1 L- 1 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

COURSE CONTENTS

Current advances in Wireless and Optical Communications as defined by instructor-
Following is suggested but not restrictive:

- Optical Fiber Communications
- Optical Wireless Communications
- LiFi and relevant devices
- LIDAR

(Total no. of lectures- 12)

COURSE OUTCOMES

CO1: To analyze & design devices used in optical communications (simulation/fabrication).
CO2: To enable her/him to perform research problem solution in a niche & socially relevant area

Recommended Readings

Current literature from quality journals & magazines such as IEEE, IET etc. & others;
Books on niche areas;

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : **ECT685**

Course Name : **Special Modules in WOC – 3**

Credits : 1 L- 1 T- 0 P- 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Current advances in Wireless and Optical Communications as defined by instructor- Following is suggested but not restrictive:

- 5G Communication Technologies
- Advanced Computational Electromagnetic Techniques
- Future Wireless Communication Transceivers
- Plasmonics and Plasma Sciences

(Total no. of lectures- 12)

COURSE OUTCOMES

CO1: To analyze & design devices used in optical communications (simulation/fabrication).

CO2: To enable her/him to perform research problem solution in a niche & socially relevant area

Recommended Readings

Current literature from quality journals & magazines such as IEEE, IET etc. & others; Books on niche areas;

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT687

Course Name : Special Modules in WOC– 4

Credits : 1 L - 1 T - 0 P - 0

Course Type : Core / Elective

Prerequisites : none

Course Contents

Current advances in Wireless and Optical Communications as defined by instructor- Following is suggested but not restrictive:

- Wideband Antennas,
- Terahertz Technology
- Millimetre/Sub-millimetre wave communications
- Deep space communications **(Total no. of lectures-12)**

COURSE OUTCOMES

CO1: To analyze & design devices used in optical communications (simulation/ fabrication).

CO2: To enable her/him to perform research problem solution in a niche & socially relevant area

Recommended Readings

Current literature from quality journals & magazines such as IEEE, IET etc. & others; Books on niche areas;