MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
M.Tech. ECE Scheme

Semester. I

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECT661	Advanced Digital Communication Systems	Program Core	Theory	3	3	0	0
2	ECT665	Advanced Microwave Engineering	Program Core	Theory	3	3	0	0
3	ECT914	Mathematical Modelling and Simulation for Communication System	Program Core	Theory	2	2	0	0
4		Program Elective-I	Program Elective	Theory	3	3	0	0
5		Program Elective-II	Program Elective	Theory	3	3	0	0
6	ECP-667	Communication Lab-I	Program Core	Lab	3	0	0	3
		Total Semester Credit			**17**			

Semester. II

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECT681	Advanced Antenna Engineering	Program Core	Theory	3	3	0	0
2	ECT683	Advanced Mobile and Wireless Networking	Program Core	Theory	3	3	0	0
3		Program Elective-III	Program Elective	Theory	3	3	0	0
4		Program Elective-IV	Program Elective	Theory	3	3	0	0
5		Program Elective-V	Program Elective	Theory	3	3	0	0
6	ECP668	Communication Lab-II	Program Core	Lab	2	0	0	2
7		Program Elective-VI	Program Elective	Lab	1	0	0	2
		Total Semester Credit			**18**			

Semester. III

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECD659	Dissertation	Program Core	Dissertation	8	0	0	16
2	ECD666	Minor Project	Program Core	Research Project	4	0	0	8
		Total Semester Credit			**12**			

Semester. IV

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1	ECD660	Dissertation	Program Core	Dissertation	12	0	0	24
		Total Semester Credit			**12**			
		Total credits of all semesters			**59**			

Credit Summary					
Semester I	Program Core Courses	11	Taught Courses	17	
	Program Electives	6			
Semester II	Program Core Courses	8	Taught Courses	18	
	Program Electives	10			
Semester III	Dissertation	8	Dissertation, Research Project	12	
	Research Project	4			
Semester IV	Dissertation	12	Dissertation	12	
	Total	**59**	**Total**	**59**	

Category	Credits
Program Core	19
Program Electives	16
Open Elective	0
Dissertation, Research Project, Seminar	24
Total Credits	59

S.No.	Course Code	Course Title	Credit	L	T	P
		List of Program Electives (indicative and NOT limited to)- Any course from M.Tech. (Wireless and Optical Communication, VLSI & Embedded) streams is also included.				
1	ECT655	Optical Codes and Applications	3	3	0	0
2	ECT662	Advanced Digital Signal & Image Processing	3	3	0	0
3	ECT664	Estimation and Detection	3	3	0	0
4	ECT666	Optical Networks	3	3	0	0
5	ECT670	Satellite Communication and Radar Engg.	3	3	0	0
6	ECT674	Cryptography	3	3	0	0
7	ECT678	Design of MIC's & MMIC's	3	3	0	0
8	ECT682	Smart and Phased Array Antenna Design	3	3	0	0
9	ECT684	Advanced topics in Communication	3	2	0	2
10	ECT686	Photonic Integrated Devices and Systems	3	3	0	0
11	ECT688	EMI/EMC	3	3	0	0
12	ECT689	Photonic Switching	3	3	0	0
13	ECT690	Wireless Sensor Networks	3	3	0	0
14	ECT692	Computational Electromagnetics	3	3	0	0
15	ECT694	Advanced Photonic Devices and Components	3	3	0	0
16	ECT696	Telecomm. Technology & management	3	3	0	0
17	ECT698	Advanced Networking analysis	3	3	0	0
18	ECT656	Adaptive Signal Processing	3	3	0	0
19	ECT657	VLSI signal processing architectures	3	3	0	0
20	ECT655	Optical Codes and Applications	3	3	0	0
21	ECT663	Advanced Error Control Codes	3	3	0	0
22	ECT693	Computer Communication & Networking	3	3	0	0
23	ECT673	Advanced Optical Communication Systems & Networks	3	3	0	0
24	ECT685	Short Range Wireless Communication Technologies	3	3	0	0
25	ECT687	Multirate Signal Processing	3	3	0	0
26	ECP900	Technical documentation	1	0	0	2
27	ECT671	Special Modules in ECE - 1(over and above the scheme)	1	1	0	0
28	ECT673	Special Modules in ECE - 2(over and above the scheme)	1	1	0	0
29	ECT675	Special Modules in ECE - 3(over and above the scheme)	1	1	0	0
30	ECT677	Special Modules in ECE– 4(over and above the scheme)	1	1	0	0
31	ECT671	Special Modules in WOC - 1(over and above the scheme)	1	1	0	0
32	ECT673	Special Modules in WOC - 2(over and above the scheme)	1	1	0	0
33	ECT675	Special Modules in WOC - 3(over and above the scheme)	1	1	0	0
34	ECT677	Special Modules in WOC– 4(over and above the scheme)	1	1	0	0

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT661

CourseName : Advanced Digital Communication Systems

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

Course Type : Core

Prerequisites : none

Course Contents

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.

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

Communication link analysis: Link budget analysis, Simple link analysis, system trade-offs, and Modulation coding trade-offs.

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

Recommended Readings

1. Text books-
   a. Digital Communications-Bernard Sklar, Fredric Harris, Pearson Education
   b. Digital Communications- John G.Proakis, McGraw Hill Education.
   c. Modern Digital and Analog Communication-B.P. Lathi, Oxford University Press.
2. Online resources-
   a. https://nptel.ac.in/courses/108/102/108102120/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT665

Course Name : Advanced Microwave Engineering

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

Course Type : Core

Prerequisites : none

Course Contents

Review of Electromagnetic Theory, Transmission Lines and Waveguides, Impedance Matching and Tuning; Analysis of microwave networks and components based on different parameters of two port network; Microwave linear beam and crossed field tubes; Introduction to different microwave solid state devices; Introduction to striplines; Microwave filters, amplifiers and oscillators

Recommended Readings

1. Text books-
    a. Microwave Devices and Circuits- Samuel Y. Liao, Prentice Hall
    b. Microwave and Radar Engineering- Kulkarni, McGraw Hill Education
    c. Microwave Solid State Circuit Design- Inder Bahl, John Wiley & Sons.
    d. Microwave circuits & passive devices- Sisodia and Raghuvanshi, New Age International.
    e. Radio-Frequency And Microwave Communication Circuits-Devendra K. Mishra, Wiley
2. Reference books-
    a. Microwave engineering-David M. Pozar, John Wiley & Sons, Inc.
    b. Introduction to Microwaves –Wheeler G.J., Prentice-Hall
    c. Foundations of Microwave Engg.- Collin, John Wiley and Sons
3. Online resources
    a. https://nptel.ac.in/courses/108/103/108103141/
    b. https://nptel.ac.in/courses/108/105/108105181/
    c. https://nptel.ac.in/courses/108/101/108101112/
    d. https://nptel.ac.in/courses/117/105/117105138/
    e. https://nptel.ac.in/courses/117/105/117105130/
    f. https://nptel.ac.in/courses/117/101/117101119/
    g. https://nptel.ac.in/courses/117/105/117105122/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : ECT673

Course Name : **Advanced Optical Communication Systems & Networks**

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

Course Type : Elective

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.

Optical networks- Basic networks-SONET/ SDH-wavelength routed networks - Nonlinear effects on network performance, performance of various systems (WDM, DWDM + SOA).

Recommended Readings

1. Text book-
    a. Fiber-Optic Communication Systems - Govind P. Agrawal, Wiley.
    b. Optical communication systems - Franz and Jain, Narosa Publications, New Delhi
2. Online resources-
    a. https://nptel.ac.in/courses/117101002/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : **ECT910**

Course Name : **Modelling, Optimization & Transforms**

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

    Course Type : Elective

    Prerequisites : none

Course Contents

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.

Direct Modeling (identification), Inverse Modeling (Equalization), Classification and Clustering, Prediction/Forecasting, Auto regressive models (AR, MA, ARMA).

Problem formulation, Linear Programming Problems, Solution by Graphical Methods, Symmetric Dual Problems, Slack and Surplus Variables, Simplex Method, Convex- Concave PHigher Order Statistics, Principal Component Analysis, Linear Discriminant Analysis, Independent Component Analysis.

Recommended Readings

1. Text books-
    a. Digital Signal Processing: Principles, Algorithms, and Applications 4 Edition - John G. Proakis, Dimitris G Manolakis, Pearson.
    b. Wavelets and Signal Processing - Hans-Georg Stark, Springer
    c. Localization of the complex spectrum: the S transform –R. G. Stockwell, L. Mansinha, and R. P. Lowe, IEEE Transactions on Signal Processing, Volume: 44, Issue: 4, Apr 1996.
2. Reference books-
    a. Engineering Optimization: Theory and Practice -Singiresu S. Rao, New Age Publishers
    b. Data Mining - Concepts and Techniques - Jain Pei, Jiawei Han and Micheline Kamber, Elsevier
3. Online resources-
    a. The Wavelet Tutorial : The Engineer's Ultimate Guide to Wavelet Analysis- RobiPolikar, 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 : ECT912

Course Name : **Reduced order Modeling, Optimization & Machine intelligence**

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

Course Type : Elective

Prerequisites : none

Course Contents

[The following contents intend to cover implicit application to and exemplification through ECE research problems in Electronic systems/Cognitive-systems domain such as reduced order polynomials, order reduction of a transfer function, sparse matrix based solution of large systems, discrete structures, implementation of search algorithms for design space exploration, and computer arithmetic implementation alongwith probabilistic reasoning for AI]

Reduced order modelling & large Eigen value methods-

(i) (a) Large Matrix analysis and large Eigen value problem– Groups, fields and rings; vector spaces; basis & dimensions; canonical forms; inner product spaces- orthogonalization, Gram-Schmidt orthogonalization, unitary operators, change of orthonormal basis, diagonalization; (b) Eigenvalues & eigen vectors- Gerschghorin theorem, iterative method, Sturm sequence, QR method, introduction to large eigen value problems

(ii) Reduced order modelling of systems- Taylor's polynomial, least square approximation, Chebyshev series/polynomial, curve fitting & splines, Pade& rational approximation

Discrete Structures, algorithms & Combinatorial optimization- counting methods, algorithm analysis, graph algorithms, dynamic algorithms, randomized algorithms, probabilistic algorithms, combinatorial optimization

Digital arithmetic & machine intelligence- (i) Number theory & computer arithmetic- unconventional number systems, residue number system, logarithmic number system, Chinese remainder theorem; fast evaluation of elementary & transcendental arithmetic functions.

(ii) Preface to AI- first order logic & inferencing, uncertainty, probabilistic reasoning systems, making decisions under uncertainty.

Recommended Readings

1. Text books-
   a. Schaum's outline on Linear Algebra-Seymour Lipschutz and Marc Lipson , McGraw Hill
   b. Topics in Algebra - I. N. Herstein, Wiley.
   c. Advanced Model Order Reduction Techniques in VLSI Design - Sheldon Tan, Le He, Cambridge Univ. Press, 2007.
   d. Model Order Reduction: Theory, Research Aspects and Applications - W. H. A. Schilders, Henk A. Van Der Vorst, Joost Rommes, Springer.
   e. Applied Numerical Analysis - C.F.Gerald and P. O.Wheatley, Pearson.
   f. Theory and Applications of Numerical Analysis, G. M. Phillips, Peter J. Taylor, Academic press.
   g. Introduction to Algorithms - T.H.Cormen,R.L. Rivest, C.E.Leiserson and C.Stein, PHI.
   h. Combinatorial optimization - Christos H. Papadimitriou and Kenneth Steiglit, PHI (I)
   i. Computer Arithmetic Algorithm- Israel Koren, CRC Press.

2. Reference books-
    a. Model Order Reduction Techniques With Applications In Electrical Engineering - Luigi Fortuna, Guiseppe Nunnari and Antonio Gallo, Springer, 1992.
    b. Numerical methods for large Eigenvalue Problems- Y. Saad, Society for Industrial and Applied Mathematics, Philadelphia.
    c. Matrix Analysis & linear algebra - Carl Meyer, SIAM.
    d. Iterative methods for large linear systems - H. A. van der Vorst, citeseerx.ist.psu.edu
    e. Symbolic analysis and reductions of VLSI circuits - Cheng et al, Springer, 2005

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECP667

Course Name : Communication Lab-I

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

Course Contents

Course will deal with relevant experiments of communication engineering.

Recommended Readings

1. Communication Lab Manual

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT681

Course Name : Advanced Antenna Engineering

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

Course Type : Core

Prerequisites : None

Course Contents

Revision of radiation mechanism of antenna, basic performance parameters of antenna like radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, etc. Basic theorems related to antenna. Introduction to the working principles and analysis of different kinds of antenna geometries like microstrip, broadband, frequency independent, travelling wave antennas etc.

Recommended Readings

1. Text book-
   a. Antenna Theory:Analysis and Design - C. A. Balanis, Wiley Publication,2000.
   b. Antenna Theory- J. D. Kraus, 4th Edition, Tata Mc-Graw Hill.
   c. Antenna Theory and Design - W. L.Stutzman, and G. A. Thiele, John Wiley & Sons., 1998.
   d. Antenna Theory and Design - R. S. Elliot, Revised edition, Wiley-IEEE Press, 2003.
   e. Antennas and Radio Wave Propagation - R. E. Collin, McGrawHill., 1985.
   f. Smart Antennas for Wireless Communications - F. B. Gross, McGraw-Hill., 2005
   g. Micro strip Antenna Design Handbook - Ramesh Garg, Prakash Bhartia, Inder Bahl, Artech House.
   h. Handbook of Antennas in Wireless Communication - Lal Chand Godara, CRC Press.
2. Reference book-
   a. CAD of Microstrip Antenna for Wireless Applications - Robert A. Sainati, Artech House.
   b. Compact and Broadband Micro strip Antenna - Kin-Lu Wong, John Wiley & Sons.
   c. Microstrip Patch Antennas - Robert B. Waterhouse, Kluwer academic Publishers.
   d. Handbook of Microstrip Antennas - J.R. James and P.S. Hall, Peter Peregrinus Ltd.

3. Online resources-
   a. https://nptel.ac.in/courses/108/101/108101092/
   b. https://nptel.ac.in/courses/108/105/108105114/
   c. https://nptel.ac.in/courses/117/107/117107035/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : ECT683

Course Name : **Advanced Mobile and Wireless Networking**

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

Course Type : Core

Prerequisites : None

Course Contents

Operation of Cellular Systems, Frequency reuse concept, Co-channel Interference, Techniques for reducing co-channel interference, Adjacent channel interference, Near end and Far end interference, Crosstalk, interference between systems.

Channel Assignment Techniques, Hand-off Techniques, Concept of smaller Cells, Trunking and Teletraffic Theory

Orthogonal Frequency Division Multiplexing, Orthogonal Frequency Division Multiple Access, MIMO-OFDM, Effect of frequency offset in OFDM, Peak to average power ratio (PAPR) in OFDM Cognitive Radio and Software Defined Radio Concepts. Evolution of Mobile Communication Systems, Details of 3G-UMTS, 4G-LTE and 5G Mobile Communication systems.

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,

Recommended Readings

1. Text book-
   a. Mobile Cellular Telecommunications- William C.Y. Lee, TMH.
   b. Wireless Communications - T S Rappaport, IEEE Press.
   c. Wireless Communication and Networking - John W. Mark, WeihuaZhuang.
   d. Wireless Adhoc Networks - M. Ilyas, CRC Press.
2. Reference book-
   a. Wireless and Mobile Communication Systems - D. P. Agarwal & Qing Anzen, Thomson Press

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : **ECT914**

Course Name : **Mathematical Modelling and simulation for Communication Engineering Systems**

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

Course Type : Core

Prerequisites : None

Course Contents

[The Course contents are aimed to cover Mathematical Modelling and Design Concepts related to research problems in Communication Engineering Systems)

Mathematical Foundational concepts for Communication Engineering: Basics of Linear Algebra, Probability and Random Variables, Stochastic Processes, Spectral Representation, Mean Square Estimation, Entropy, Markov Chains, Processes and Queuing Theory, Mathematical modelling of digital modulations, channels and detection, Channel estimation and equalization, MIMO-OFDM design concepts, Research initiatives in 4G, 5G Mobile Systems
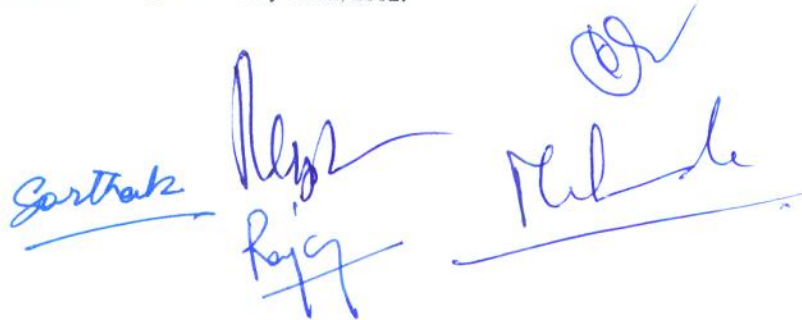
Mathematical Foundations for Photonics/Electromagnetics: Vector Analysis, Vector Calculus, Theory of complex variables, Series Solution of Differential Equations, Sturm Liouville Theory, Bessel Functions, Legendre Functions, Fourier Series and Fourier Transforms, Solving surface integral equations by method of moments, Introduction to finite element methods, Finite element method in 2D, Finite difference time domain method – introduction, Finite difference time domain method - materials and boundary conditions, Finite difference time domain method Design concepts in Microstrip Antennas and Arrays, Beam forming Techniques, SIW

Partial Differential Equations: Laplace and Poisson's Equations, Wave Equations. Analytical and Numerical Solutions of the PDEs. Green's Function, Optimization techniques.

Simulation Tools: Various open source/commercial software for solving problems in the area of Antennas, Communication, Photonics and Microwave Engineering

Recommended Readings

1. Text books-
    a. Probability, random variables and stochastic processes. - Papoulis, Athanasios, and H. Saunders.
    b. The theory of information and coding - Robert J. McEliece, Cambridge University Press.
    c. Advanced engineering electromagnetics - Constantine A. Balanis, John Wiley & Sons.
    d. Computational Methods for Electromagnetics - Peterson, Ray, Mitra, IEEE Press
    e. Microstrip Antennas: The Analysis and Design of Microstrip Antennas and Arrays - David M. Pozar, Daniel H. Schauber, Wiley-IEEE Press.
2. Reference books-
    a. Microstrip Antennas - I. J. Bahl and P. Bhartiya, Artech House.
    b. Mathematical methods for physics and engineering: A Comprehensive Guide - K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press, 2002.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT668

Course Name : Communication Lab-II

Credits : 2   L - 0   T - 0   P - 2
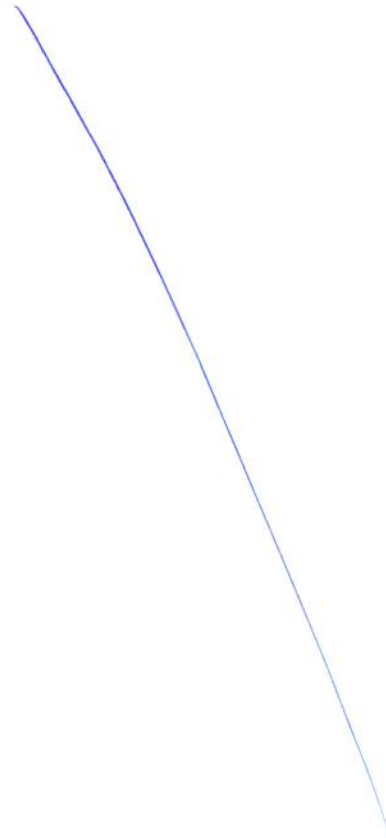
Course Type : Core

Prerequisites : None

Course Contents

Course will deal with relevant experiments to advance communication

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 : 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.

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

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

Referring articles: Using labels, Citing articles, Bibliography, Bibtex, Styles, Mendeley, JabRef

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

Reformatting documents, Responding to reviewer comments, Reviewing technical documents.

Recommended Readings

1. Guide to LaTeX - H. Kopka and P. W. Daly, Boston: Addison-Wesley, 2013.

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 : 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.

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.

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

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

Recommended Readings

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

Recommended Readings

1. Text books-
    a. Digital Signal Processing- Oppenheim A.V. & Schafer R.W, PHI.
    b. Digital Signal Processing-Mitra, TATA McGraw Hill Publications.
    c. Digital Image Processing- Gonzalez / Woods, Pearson Education.
2. Reference books-
    a. Digital Image Processing- A.K. Jain, Prentice Hall Information and System Sciences Series.
    b. Digital Picture Processing- Azriel Rosenfeld and Avinash C. Kak, Academic Press Inc.
3. Online resource-
    a. 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 : Elective

Prerequisites : none

Course Contents

Classical Detection Theory: Decision Theory; Binary Decisions, Gaussian Noise; Detection in Gaussian Noise;

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

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,

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

Recommended Readings

1. Text books-
   a. Detection, Estimation, and Modulation Theory - H. L. Van Trees, Vol. 1, Wiley Interscience, 2001.
   b. Elements of Signal Detection and Estimation - C. W. Helstrom, Prentice Hall, 1995.
   c. An Introduction to Signal Detection and Estimation - H. V. Poor, Springer, New York, 1994.

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 : Elective

Prerequisites : none

Course Contents

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.

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

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

Recommended Readings

1. Text book–
   a. WDM Optical Networks - C. Sivaramamurthy & M. Gurusamy, PHI.
   b. Optical Networks (3/e) - R. Ramaswami & K. N. Sivarajan, Elsevier.
2. Online resources-
   a. https://nptel.ac.in/courses/108/106/108106167/

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 : Elective

Prerequisites : none

Course Contents

Introduction to satellite communication and different types of orbits; orbital mechanics and parameters, Satellite subsystems, space link design

Multiplexing and access techniques for satellite communication; introduction to spread spectrum; Global navigation satellite systems (GNSS)

Internet and satellite links; very small aperture antenna; special purpose satellites

Fundamentals of radar systems, Radar modalities, basic operating principles (detection, ranging, Doppler, importance of phase), radar system components

Recommended Readings

1. Text books–
    a. Introduction to Radar Systems - Merrill I. Skolnik, McGraw-Hill
    b. Satellite communication systems - B. G. Evans, IET
    c. Satellite Communication - P. Banerjee, PHI
2. Online resources-
    a. https://nptel.ac.in/courses/117/105/117105131/
    b. 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 : Elective

Prerequisites : none

Course Contents

Cryptography: Basic Terms and Concepts, Brief History of Cryptography and Cryptanalysis. 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.

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.

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.

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

Recommended Readings

1. Text book–
   a. Cryptography and Network Security: Principles and Practice - Williain Stallings,Pearson Education, 2000.
   b. Communication network Management – KernalTexpalan, PHI, 1992.
   c. Computer Networks and Internet - D.E. Cormer, 2nd Edition, Addison Wesley Publication, 2000.

2. Reference book-
   a. Handbook of Cyber Laws - Sharma, Vakul, Macmillan India Ltd, 2002.
3. Online resources-
   a. 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 : 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.

Recommended Readings

1. Text book–
   a. Microwave Material and fabrication techniques –T. Laverghetta, Artech House
   b. Microstrip Line and Slot Lines - KC Gupta, R garg, I Bahl and P Bhartia, Artech House
   c. Computer Aided Analysis of Nonlinear Microwave Circuits - Paulo J. C. Rodrigues, Artech House
2. Reference book-
   a. The RF and Microwave Circuit Design Cookbook - SA Mass, Artech House
3. Online resources-
   a. 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 : Elective

Prerequisites : none

Course Contents

Review of Antenna Theory, Analysis and Design, Introduction, Smart Antenna analogy, Signal Propagation, Strengths and Shortcomings, Beamforming, Mobile Adhoc Networks, Design, Simulation and Results.

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. 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.

Recommended Readings

1. Text books–
    a. Smart antennas for wireless communications - Frank Gross, McGraw-Hill, 2006.
    b. Phased array antenna handbook - R. J. Mailloux, Artech house, 2005.
    c. Phased Array Antennas - R.C. Hansen, Wiley, 1997.

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 : Elective

Prerequisites : none

Course Contents

Advanced topics in: Multiuser Detection Techniques, Wireless Networking, Optical Networking, Signal Processing, Mobile Communication, Computer Networking, and their applications.

Recommended Readings

1. Text books–
   a. Wireless Communications & Networks - William Stallings, Prentice Hall.
   b. Mobile & Cellular Telecommunication - W.C.Y Lee. McGraw-Hill
   c. Digital Signal Processing- A.V. Oppenheim and R.W. Schafer, 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 : Elective

Prerequisites : none

Course Contents

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.

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.

Recommended Readings

1. Text book–
    a. Integrated Optics - Robert G. Hunsperger, Springer.
    b. Integrated Photonics: Fundamentals – GinésLifante, John Wiley and Sons.
2. Online resources-
    a. https://nptel.ac.in/courses/117/108/117108142/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : ECT688

Course Name : EMI/EMC

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

Course Type : Elective

Prerequisites : none

Course Contents

Introduction to EMC-EMI standards, EMC Requirements for Electronic Systems, Digital Signal Spectra: Time and Frequency Domain. PCB Track as Transmission Lines, Signal Integrity, Non ideal behavior of Circuit Components, Antennas. Conducted Emissions and Susceptibility, Radiated Emissions and Susceptibility, Crosstalk, Shielding. System Design, Pre-compliance Measurements.

Recommended Readings

1. Text book–
    a. Introduction to Electromagnetic Compatibility - Clayton Paul, Wiley
    b. Electromagnetic Compatibility Engineering - Henry W. Ott, Wiley.
    c. Foundations of Electromagnetic Compatibility: with Practical Applications - Bogdan Adamczyk, Wiley
2. Online resources-
    a. https://nptel.ac.in/courses/108/106/108106138/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : <u>Department of Electronics and Communication Engineering</u>

Course Code : <u>ECT689</u>

Course Name : <u>Photonic Switching</u>

Credits : <u>3</u> L - <u>3</u> T - <u>0</u> P - <u>0</u>

Course Type : Elective

Prerequisites : none

Course Contents

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.

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.

Switch Architectures: Introduction to various architectures & algorithms for building large switches, Cross, Clos, Banyan architecture, Benes architecture, Spanke architecture, Spanke- Benes architecture, etc.

Switching in Optical Networks, Opaque Switching, Challenges for Optical Switching, Optical Switching Paradigms, nano photonic switches.

Recommended Readings

1. Text book–
   a. Optical Switching - G.I Papadimitriou, C. Papazoglon and A.S Pomportsis, Wiley Series In Microwave & Optical Engg.
   b. Optical components for communications - Ching-Fuh Lin, Kluwer academic publishers.
   c. Photonics - 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 : 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

Recommended Readings

1. Text book–
   a. Ad Hoc Wireless Networks: Architectures and Protocols - Murthy & Manoj, Pearson.
   b. Wireless Communications & Networks - William Stallings, Prentice Hall.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : **ECT692**

Course Name : **Computational Electromagnetics**

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

Course Type : Elective

Prerequisites : none

Course Contents

Review of Electromagnetic Theory, Classification of EM Problems.
Analytical Methods-Separation of Variables. Finite Difference Methods. Variation Methods. Method of Moments. Finite element Method.

Recommended Readings

1. Text book–
   a. Numerical Techniques in Electromagnetics - Matthew N.O. Sadiku, CRC Press.
   b. Theory and Computation of Electromagnetic Fields – Jianming Jin, Wiley.
2. Online resources-
   a. 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 : 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.

Recommended Readings

1. Text book—
   a. Fiber Optic Communication systems - G. P. Aggarwal, Wiley Eastern
   b. Introduction to Fiber Optics - A. Ghatak and K. Thyagarajan, Cambridge Univ. Press
   c. Introduction to Optical Electronics - K. A. Jones, Harper & amp; 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 : Elective

    Prerequisites : none

Course Contents

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

Recommended Readings

1. Text book-
    a. Data and Computer Communication - W. Stallings, Pearson Education

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
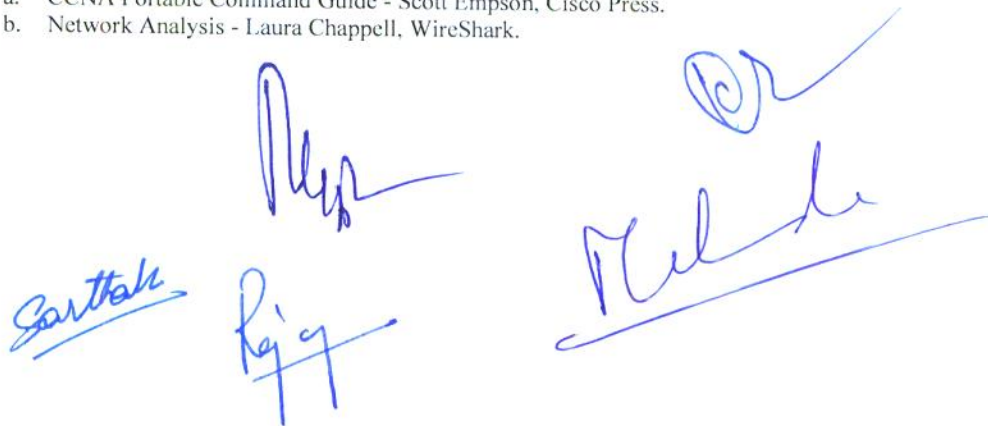
Course Type : Elective

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.

Recommended Readings

1. Text book-
   a. CCNA Portable Command Guide - Scott Empson, Cisco Press.
   b. Network Analysis - Laura Chappell, WireShark.

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 : 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.

Recommended Readings

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

2. Online resources-
   a. 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 : Elective

Prerequisites : None

Course Contents

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.

Iteration Bound Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs

Pipelining and Parallel Processing: Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving

Retiming, Unfolding and Folding: retiming techniques; algorithm for unfolding, Folding transformation, Techniques of retiming, Unfolding & Folding

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

Low power Design Theoretical background , Scaling v/s power consumption, power analysis, Power reduction techniques, Power estimation approach

Recommended Readings

1. Text book-
   a. VLSI Digital Signal Processing System : Design and implementation - K. K. Parhi, Wiley.
   b. Digital Signal Processing with Field Programmable Gate Arrays - Uwe Meyer-Baese , Springer.
   c. FPGA-Based Implementation of Signal Processing Systems - Roger Woods, John Mcallister, Wiley.

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 : 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.

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

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

Recommended Readings

1. Text book-
    a. Optical code division multiple access: Fundamentals and Applications - Paul R. Prucnal, CRC Press.
    b. Optical coding theory with prime - Wing C. Kwong, GuuChang Yang, CRC Press.
    c. Spreading Codes for All-Optical Code Division Multiple Access Communication Systems- M. Ravi Kumar (Ph.D. Thesis, IIT Kharagpur)
    d. 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 : **ECT663**

Course Name : **Advanced Error Control Codes**

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

Course Type : 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.

Recommended Readings

1. Text book-
   a. Digital Modulation &Coding - Stephen G. Wilson, Prentice Hall Inc.
   b. Information Theory Coding and Cryptography - Ranjan Bose, TMH
   c. Theory and practice of error control codes -R. E. Blahut, AWL1983.
   d. Digital Communication - J. G. Proakis, McGraw Hill Education.
2. Online resources-
   a. https://nptel.ac.in/courses/117/108/117108044/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : ECT693

Course Name : **Computer Communication & Networking**

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

   Course Type : Elective

   Prerequisites : none

Course Contents

Introduction to data communication. Concept of analog and digital signals. Network topologies. Basics of OSI and TCP/IP reference models. Client-server communications. Transmission media. Wired and wireless connectivity. FDM, TDM and CDMA. Circuit and packet switching. Frame relay and ATM switching. ISDN.
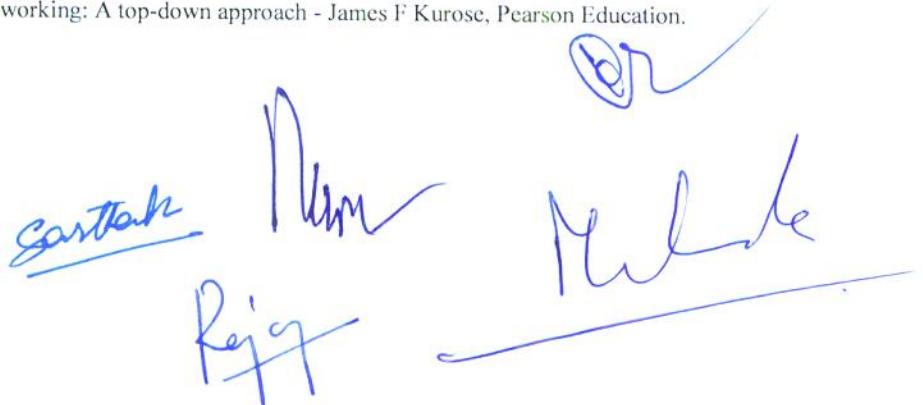
Local area network protocols. IEEE standards for LAN. Data link layer design issues: its functions and protocols. Internet protocol. Routing algorithms. Congestion control algorithms.

IP addressing schemes. Internetworking and sub-netting. IPv4 and IPv6, Transport protocols, TCP & UDP, Connection management. Network management , SNMP, Internet Applications- Electronic mail, HTTP, DNS

Introduction to the Concept of Security, The Data Encryption Standard, Cryptographic Techniques, Computerbased Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key cryptography & RSA, Biometric based Key generation, Machine learning in cryptography, State-of-the-art in cryptography & Network Security

Recommended Readings

1. Text book-
     a. Data and Computer Communications - William Stallings, Pearson Education
     b. Cryptography and network security: Principles and practice - William Stallings, Pearson Education.
     c. Computer Networks -Andrew S. Tanenbaum, Pearson Education.
     d. Computer Networking: A top-down approach - James F Kurose, Pearson Education.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT685

Course Name : Short Range Wireless Communication Technologies

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

Course Type : Elective

Prerequisites : none

Course Contents

Introduction, Active RFID Vehicular networks, Bluetooth
NFC, Zigbee Combination of these technologies

Recommended Readings

1. Text book-
   a. RFID: A Guide To Radio Frequency Identification -Hunt, V. Daniel, Albert Puglia, and Mike Puglia, John Wiley & Sons, 2007.
   b. Vehicular networks: from theory to practice - Olariu, Stephan, and Michele C. Weigle, CRC Press, 2009.
   c. Wi-Fi, Bluetooth, Zigbee and WiMax - Labiod, Houda, Afifi Hossam, and Costantino De Santis, Springer-Verlag, 2007.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : **ECT687**

Course Name : **Multirate Signal Processing**

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

Course Type : Elective

Prerequisites : None

Course Contents

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.

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.

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.

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.

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

Recommended Readings

1. Text book-
   a. Multirate systems and filter banks - P. Parishwad Vaidyanathan, Pearson Education India, 2006.
   b. Multirate digital signal processing - Rabiner, R. Lawrence, Prentice Hall PTR, 1996

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

3. Online resources-
   a. https://nptel.ac.in/courses/117/102/117102060/
   b. https://onlinecourses.nptel.ac.in/noc19_ee50/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code	:	ECT671
Course Name	:	**Special Modules in ECE – 1 (over and above the scheme)**

Credits	:	1 L - 1 T - 0 P - 0
Course Type	:	Elective
Prerequisites	:	None

Course Contents

Current advances in Electronics and Communication Engineering as defined by instructor- Following is suggested but not restrictive:
Optical devices and relevant materials/ Optical Sensors

Recommended Readings

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

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code : ECT673

Course Name : Special Modules in ECE – 2 (over and above the scheme)

Credits : 1   L - 1   T - 0   P - 0
Course Type : Elective
Prerequisites : None

Course Contents

Current advances in Electronics and Communication Engineering as defined by instructor- Following
is suggested but not restricted
Wireless Communication Technology

Recommended Readings

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

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code	:	ECT675
Course Name	:	**Special Modules in ECE – 3 (over and above the scheme)**

Credits	:	1	L - 1	T - 0	P - 0	
Course Type	:	Elective				
Prerequisites	:	None				

Course Contents

Current advances in Electronics and Communication Engineering as defined by instructor- Following is suggested but not restrictive:
VLSI and Embedded Systems

Recommended Readings

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

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code	:	ECT677
Course Name	:	**Special Modules in ECE – 4 (over and above the scheme)**

Credits	:	1 L - 1 T - 0 P - 0
Course Type	:	Elective
Prerequisites	:	None

Course Contents

Current advances in Electronics and Communication Engineering as defined by instructor- Following is suggested but not restrictive:
Artificial Intelligence and Machine Learning

Recommended Readings

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

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

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

Course Code   :   **ECT681**

Course Name   :   **Special Modules in WOC – 1 (over and above the scheme)**

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

    Course Type   :   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

Recommended Readings

    a.   Current literature from quality journals & magazines such as IEEE, IET etc. & others;
    b.   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 (over and above the scheme)**

Credits	:	1	L -	1	T -	0	P -	0
Course Type	:	Elective						
Prerequisites	:	None						

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

Recommended Readings

a. Current literature from quality journals & magazines such as IEEE, IET etc. & others;
b. 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 (over and above the scheme)**

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

Course Type : 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

Recommended Readings

a. Current literature from quality journals & magazines such as IEEE, IET etc. & others;
b. 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 (over and above the scheme)**

Credits	:	1 L - 1 T - 0 P - 0
Course Type	:	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
- Millimeter/Sub-millimeter wave communications
- Deep space communications

Recommended Readings

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