JAIDEV EDUCATION SOCIETY'S

JD COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD,NAGPUR
Website:www.jdcoem.ac.in E-mail:info@jdcoem.ac.in
(An Autonomous Institute, with NAAC "A" Grade)
Affiliated to DBATU, RTMNU & MSBTE Mumbai
Department of Electronics and Telecommunication Engineering
"Rectifying Ideas, Amplifying Knowledge"
Session: 2024-25

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	**1.To provide quality teaching learning process through well-developed educational environment and dedicated faculties.** **2.To produce competent technocrats of high standards satisfying the needs of all stakeholders.**

Program: B.Tech Electronics and Telecommunication Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7T001	Digital Communication	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of communication engineering

Prior Reading Material / useful links	
1	https://www.ojcmt.net/article/digital-communication-in-educational-process-development-trends-and-new-opportunities-7928
2	https://journals.ala.org/index.php/lrts/article/view/5158/6260

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	**Understand** various techniques of digital communication Systems.
2	CO2	**Explain** the knowledge of waveform coding and practice related to Digital communication.
3	CO3	**Identify** and solve engineering problems related to Mobile communication system.
4	CO4	**Analyze** the spectral characteristics of band pass signaling schemes and their noise performance.
5	CO5	**Design** error control coding schemes.

Syllabus:

Course Contents	
Unit I	**Information Theory** Discrete Memoryless source, Information, Entropy, Mutual Information-Discrete Memory less channels – Binary Symmetric Channel, Channel Capacity -Hartley-Shannon law - Source coding theorem - Shannon – Fano & Huffman codes. **[5Hours]**
Unit II	**Waveform Coding & Representation** Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ– Manchester **[6Hours]**
Unit III	**Baseband Transmission & Reception** ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlativecoding-Eyepattern–ReceivingFilters-MatchedFilter,Correlation receiver, Adaptive Equalization **[6Hours]**
Unit IV	**Digital Modulation Scheme** Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK,BFSK & QPSK-QAM-Carrier Synchronization-Structure of Non-coherent Receivers – Principle of DPSK. **[7Hours]**
Unit V	**Error Control Coding** Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes –Viterbi Decoder. **[7Hours]**
Unit VI	**Mobile Communication** Cellular Telephone systems: Digital cellular telephone, Mobile communication system, Role of mobile communication, mobile hotspot and mobile applications related to rural development, GPS. **[5Hours]**
Text Books	
1	S. Haykin, ―Digital Communications‖, John Wiley, 2015
2	B.P. Lathi and Z. Ding, "Modern Digital and Analog Communication Systems," 4th Ed., Oxford University Press, 2009
Reference Books	
1	T. M. Cover and J. A. Thomas, "Elements of Information Theory," Wiley Student Edition, 1999, Reprint 2009
2	J.G Proakis, ―Digital Communication‖, 4th Edition, Tata McGraw Hill Company, 2001.
Useful links	
1	https://www.researchgate.net/publication/268508509_Types_of_E-Resources_and_its_utilities_in_Library
2	https://www.ojcmt.net/article/digital-communication-in-educational-process-development-trends-and-new-opportunities-7928
3	https://journals.ala.org/index.php/lrts/article/view/5158/6260

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Program: B.Tech Electronics and Telecommunication Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E002BC	Optical Communication Networks	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of communication engineering

Prior Reading Material / useful links	
1	https://nptel.ac.in/courses/108/106/108106167/
2	https://nptel.ac.in/courses/117101054

Course Outcomes: At the end of the course, students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Explain the principles of operation of various optical fiber communication systems.
2	CO2	Analyze the performance of various digital and analogue optical fiber systems.
3	CO3	Determine various key parameters of optical fiber systems.
4	CO4	Evaluate the factors affecting the performance of different optical fibre communication systems.
5	CO5	Design Optical networks

Syllabus:

Course Contents	
Unit I	**Overview of Optical Fiber Wave Guides** General system, transmission link, advantage of optical fiber communication, basic structure of optical fiber waveguide, ray theory transmission, optical fiber modesandconfiguration,stepindex&gradedindexfiber,singlemodefiber, fiber materials ,fiber fabrication. **[6Hours]**
Unit II	**Signal Degradation in Optical Fiber** Introduction, attenuation, intrinsic & extrinsic absorption losses, linear & nonlinear scattering losses, bending losses, distortion in optical wave guide, intramodal and intermodal dispersion. Power launching and coupling Source to fiberpowerlaunching,powercalculation,lensingschemes,fibertofiberjoints, fiber splicing technique, fiber connectors**.** **[7Hours]**
Unit III	**Optical Sources** LASER: Basic concepts of laser, Optical emission from semiconductors, Semiconductor injection laser (ILD), Injection laser characteristics.LED: power and efficiency, LED structures, LED characteristics. Optical detectors: p-n photodiodes, P-I-N photodiodes, Avalanche photodiodes, Quantum efficiency, speed of response, Phototransistor. **[6Hours]**
Unit IV	**Optical Receiver** Receiver operation, digital receiver noise, shot noise, pre-amplifier types, Digital receiver performance, introduction to analog receivers. **[5Hours]**
Unit V	**Digital Transmission Systems** Point to point links, system considerations, link power budget, rise time budget, modulation formats for analog communication system, introduction to WDM concepts, Introduction to advance de multiplexing strategies. **[7Hours]**
Unit VI	**Optical Networks** [6 Hours] Basic networks-SONET/ SDH-wavelength routed networks, nonlinear effects on network performance, performance of various systems (WDM, DWDM +SOA).
Text Books	
1	G.Keiser: Optical Fiber Communication – MGH
2	Jenkins & White: Fundamentals of Optics – MGH.
Reference Books	
1	Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" /Pearson Education.
2	Singh, Jasprit / "Optoelectronics An Introduction to Materials and Devices"/ McGraw-Hill
3	Khare, R.P. / "Fiber Optics & Optoelectronics" / Oxford University Press
Useful links	
1	https://nptel.ac.in/courses/108/106/108106167/
2	https://nptel.ac.in/courses/117101054

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Program: B.Tech Electronics and Telecommunication Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E002C	Advanced Cellular Communication	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of Digital and wireless Communication System.

Prior Reading Material / useful links	
1	https://crln.acrl.org/index.php/crlnews/article/view/8545/8878
2	https://eudl.eu/journal/mca
3	https://www.researchgate.net/publication/286455750_mobile_technology_in_libraries_for_discovering_e-resources_and_services

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	Understand the concept of cellular wireless communication system
2	CO2	Understand the emerging technologies required for fourth and fifth generation mobile systems .
3	CO3	Explain GSM mobile communication architecture, logical channels, advantages and limitations.
4	CO4	Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques.
5	CO5	Analyze various methodologies to improve the cellular Capacity.
6	CO6	Compare various radio access technologies for 5G networks.

Syllabus:

Course Contents	
Unit I	**Introduction to Wireless communication** Wireless communication systems, Applications of wireless communication systems, Types of wireless communication systems, trends in mobile communication systems. **[4 Hours]**
Unit II	**Cellular Mobile Systems** Basic cellular systems, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, analog & digital cellular systems. **[6 Hours]**
Unit III	**Elements of Cellular Radio System Design** Concept of frequency reuse channels, Co-channel interference reduction factor, Desired C/I from a normal case in an omni directional antenna system, Handoff mechanism, Cell splitting. **[6Hours]**
Unit IV	**Interference in Cellular Mobile System** Co-channel interference, Design of an omni directional antenna system in the worst case, Design of a directional antenna system, Lowering the antenna height, Power control, Reduction in CI by tilting antenna, umbrella pattern effect Adjacent-channel interference, Near-end – far-end interference, Effect on near-end mobile units. **[7Hours]**
Unit V	**Frequency Management, Channel Assignment and Handoffs** Frequency management, Frequency-spectrum utilization, Set-up channels, Fixed channel assignment schemes, Non-fixed channel assignment schemes, Concept of handoff, Initiation of a hard handoff, Delaying a handoff, Forced handoffs, Queuingofhandoffs,Powerdifferencehandoffs,Mobileassistedhandoff,Soft handoffs, Cell-site handoff, Intersystem handoff, dropout calls. **[7Hours]**
Unit VI	**GSM System Overview Over Wireless Networks And 5G Technology** GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM, GPRS and EDGE. Overview of Wi-Fi, Wi-MAX and Bluetooth technology (Basic features and physical specifications).5G architecture, D2D: from 4G to 5G – Radio Resource Management for Mobile Broadband D2D –5G radio access technologies. **[8 Hours]**
Text Books	
1	Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication.
2	H. Labiod, H. Afifi, C. De Santis: WI-FI, BLUETOOTH , ZIGBEE and WIMAX-Springer2007
Reference Books	
1	Asif Oseiran, Jose F.Monserrat and Patrick Marsch, "5G Mobile andWireless Communications Technology", Cambridge University Press, 2016.
2	Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015
3	Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research", Wiley, 2018arson
Useful links	
1	https://crln.acrl.org/index.php/crlnews/article/view/8545/8878
2	https://eudl.eu/journal/mc
3	https://www.researchgate.net/publication/286455750_mobile_technology_in_libraries_for_discovering_e-resources_and_services

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Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E003A	Verilog HDL	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of Digital Circuits, Microprocessor and Microcontroller.

Prior Reading Material / useful links	
1	https://onlinecourses.nptel.ac.in/noc19_cs73
2	https://www.classcentral.com/course/swayam-synthesis-of-digital-systems-10067

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	**Relate** VHDL and Verilog.
2	CO2	**Understand** the Digital Design with Verilog HDL
3	CO3	**Identify** the various modules and ports in Digital Design with Verilog HDL.
4	CO4	**Compare** the task and functions and make use of useful modeling techniques
5	CO5	**Analyze** the gate level, data flow and behavioral modeling of Digital Design with Verilog HDL.
6	CO6	**Design** digital systems with various constraints.

Syllabus:

Course Contents	
Unit I	**Overview of Digital Design with Verilog HDL** Evolution of CAD, emergence of HDLs, typical HDL-based design flow, why Verilog HDL? Trends in HDLs. **Hierarchical Modeling Concepts** Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. **[6Hours]**
Unit II	**Modules and Ports** Lexical conventions, data types, system tasks, compiler directives, Module definition, port declaration, connecting ports, hierarchical name referencing. **[5 Hours]**
Unit III	**Gate-Level Modeling** Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. **[7Hours]**
Unit IV	**Dataflow Modeling** Continuous assignments, delay specification, expressions, operators, operands, operator types. **[6Hours]**
Unit V	**Behavioral Modeling** Structured procedures, initial and always, blocking and non blocking statements, delay control, generate statement, event control, conditional statements, multi way branching, loops, sequential and parallel blocks. **[6Hours]**
Unit VI	**Tasks, Functions & Useful Modeling Techniques** Differences between tasks and functions, declaration, invocation, automatic tasks and functions. Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks. **[7Hours]**
Text Books	
1	Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition, Samir Palnitkar, Prentice Hall PTR, February 21, 2003
Reference Books	
1	Steve Kilts, "Advanced FPGA Design: Architecture, Implementation and Optimization", J.Wiley and Sons, 2007.
2	Seetharaman Ramachandran, "Digital VLSI Systems Design", Springer Verlag, 2012.
3	Peter J. Ashenden, "The designer's guide top VHDL", Morgan Kaufmann, 2008.
4	Charles H. Roth Jr., "Digital Systems Design using VHDL", Cengage Learning, 2014.
5	Digital System Design–John Wakerley, McGraw Hill Publications.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc19_cs73
2	https://www.classcentral.com/course/swayam-synthesis-of-digital-systems-10067

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Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E003B	UHF & Microwave Engineering	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of Electromagnetic field and Antenna & Wave Propagation.

Prior Reading Material / useful links	
1	https://archive.nptel.ac.in/courses/108/101/108101112/#watch
2	https://youtu.be/NW1NXoM4q5c
3	https://onlinecourses.nptel.ac.in/noc20_ee91/preview

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	Explain the use of active and passive microwave devices.
2	CO2	Demonstrate the use of different Klystrons, magnetron devices.
3	CO3	Analyze different UHF components with the help of scattering parameters.
4	CO4	Describe micro strip lines.
5	CO5	Analyze the different power distribution Tees.
6	CO6	Describe the transmission and waveguide structures and how they are used as elements in impedance matching and filter circuits.

Syllabus:

Course Contents	
Unit I	**Microwave Active Devices (O-type)** Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in Reflex klystrons, mode-frequency characteristics, Effect of repeller voltage variation on power and frequency of output. Slow wave structures, Principle and working of TWT amplifier &BWO Oscillator. **[6Hours]**
Unit II	**Microwave Active Devices (M-type)** Principle of working of M-type TWT, Magnetrons, Electron dynamics in planar and cylindrical Magnetrons, Cut off magnetic field, phase focusing effect, mode operation, Mode separation techniques, Tuning of magnetron. **[7Hours]**
Unit III	**Transmission Line** Input impedance, Standing wave distribution, Quarter Wave and Stub Matching using Smith chart, losses in Transmission lines, Planar Transmission line types, Introduction - Types of MICs and their technology, Fabrication process of MMIC, Hybrid MICs. **[6Hours]**
Unit IV	**Microwave Networks and Passive Components** Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, nonreciprocal, loss-less, Passive networks, Examples of two, three and four port networks, wave guide components like attenuator. Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Directional couplers, Microwave resonators-rectangular, Excitation of wave guide and resonators .Principles of operation of non-reciprocaldevices,propertiesofferrites,Gyrators,Isolators,Circulatorand Phase shifters. **[8Hours]**
Unit V	**Microwave Measurements** Function of Tuning Probes, Detector mounts and Detector diode, Slotted line section and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Measurement of scattering matrix parameters, High, Medium and low-level power measurement techniques, Characteristics of bolometer, bolometer mounts, Power measurement bridges, Calorimetric method, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type), Network Analyzer and its use in measurements. **[6Hours]**
Unit VI	**Microwave Solid State Devices and Application** PIN diodes-Properties and applications, Microwave detector diodes-detection characteristics, Varactor diodes, Parametric amplifier fundamentals-Manley-Rowe Power relation, MASERS, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT. **[6Hours]**
Text Books	
1	Samuel Y. Liao, 'Microwave Devices and Circuits', Pearson Education, 5th Edition.
Reference Books	
1	Manojit Mitra, 'Microwave engineering', 3rd edition, Dhanpat Rai & Company.
2	Peter A. Rizzi, 'Microwave Engineering Passive Circuits', PHI, 1999.
3	Annapurna Das, Sisir Das, 'Microwave Engineering', April 1987, Tata McGraw Hill Publication.
4	Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss , 'Microwave Principles',4th edition, 1998.
5	G. S. Raghuvanshi, 'Microwave Engineering', CENGAGE Learning

Useful links	
1	https://archive.nptel.ac.in/courses/108/101/108101112/#watch
2	https://onlinecourses.nptel.ac.in/noc20_ee91/preview

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Program: B.Tech Electronics and Telecommunication Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E004A	Machine Learning	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of programming
2	Basic knowledge of probability theory and linear algebra

Prior Reading Material / useful links	
1	https://onlinecourses.nptel.ac.in/noc22_cs29/preview
2	https://nptel.ac.in/courses/106106139

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	Understand a very broad collection of machine learning algorithms and problems.
2	CO2	Appreciate the importance of visualization in the data analytics solution.
3	CO3	Apply structured thinking to unstructured problems.
4	CO4	Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.
5	CO5	Develop an appreciation for what is involved in learning from data.

Syllabus:

Course Contents	
Unit I	**Introduction** Learning Problems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Eliminations, Inductive bias, Decision Tree learning, Representation, Algorithm, Heuristic Space Search. **[5Hours]**
Unit II	**Neural Networks and Genetic Algorithms** Neural Network Representation, Problems, Perceptrons, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming, Models of Evaluation and Learning. **[7Hours]**
Unit III	**Bayesian and Computational Learning** Bayes Theorem, Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probability Learning, Sample Complexity, Finite and Infinite Hypothesis Spaces, Mistake Bound Model. **[7Hours]**
Unit IV	**Instant Based Learning** K- Nearest Neighbour Learning, Locally weighted Regression, Radial Bases Functions, and Case Based Learning. **[6Hours]**
Unit V	**Advanced Learning** Learning Sets of Rules, Sequential Covering Algorithm, Learning Rule Set, First Order Rules, Sets of First Order Rules, Induction on Inverted Deduction, Inverting Resolution, Analytical Learning, Perfect Domain Theories, Explanation Base Learning, FOCL Algorithm, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning. "Current Streams of Thought". **[7Hours]**
Unit VI	**Introduction to Cluster Analysis & Clustering Methods** The Clustering Task and the Requirements for Cluster Analysis, Overview of Some Basic Clustering Methods, Hierarchical Methods: Agglomerate versus Divisive Hierarchical Clustering, Distance Measures, Probabilistic Hierarchical Clustering, Multiphase Hierarchical Clustering **[6Hours]**
Text Books	
1	Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2	Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
Reference Books	
1	Machine Learning Engineering, Andriy Burkov, ISBN-10 : 1999579577,True Positive Inc. (8 September 2020)
2	Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3	Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verilog.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_cs29/preview
2	https://nptel.ac.in/courses/106106139

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Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E004B	Digital Image Processing	3	0	0	3

Prerequisites for the course	
1	Signals and systems. Since DIP is a subfield of signals and systems , some knowledge about signals and systems , Calculus and probability.
2	Types of images and its coding techniques,
3	Basic programming skills.

Prior Reading Material / useful links	
1	https://nptel.ac.in/courses/117105079
2	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
3	https://nptel.ac.in/courses/117105135

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	**Recall** the fundamental concepts of a digital image processing system.
2	CO2	**Understand** images in the frequency domain using various transforms.
3	CO3	**Apply** various techniques for image enhancement and image restoration.
4	CO4	**Analyze** various compression techniques
5	CO5	**Interpret** Image compression standards.

Syllabus:

Course Contents	
Unit I	**Introduction and Digital Image Fundamentals** Digital Image Fundamentals, Need for DIP, Fundamental steps in DIP, Human visual system, Image representation – Gray scale and Color images, Types of neighborhoods, Basic relationships between pixels, Distance Measures, **[6 Hours]**
Unit II	**Basic operations on Images and Color Fundamentals.** Image addition, subtraction, logical operations, scaling, translation, rotation, Image Histogram, Color fundamentals &models – RGB, HSI YIQ, image Sampling and quantization. **[6Hours]**
Unit III	**Image Enhancement and Restoration** Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Basic gray level Transformations, Low pass filtering, High pass filtering, Noise Models, Noise Reduction, Inverse Filtering, MMSE(Wiener)Filtering, **[8Hours]**
Unit IV	**Image Compression** Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard. **[4Hours]**
Unit V	**Image Segmentation and Morphological Operations** Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative –Prewitt and Sobel, Second order derivative – LoG, DoG, Canny, Edge linking, Hough Transform, Region Growing, Region Splitting and Merging, Dilation,Erosion, Opening, Closing, Hitor-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton. **[8Hours]**
Unit VI	**Representation and Description** Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers,Fourier Descriptors. **[6Hours]**
Text Books	
1	Gonzalez & Woods, ―Digital Image Processing, 3rd ed., Pearson education, 2008
Reference Books	
1	Milan Sonka, Vaclav Hlavav, Roger Boyle, ―Image Processing, Analysis and Machine Vision‖, 2nd ed., Thomson Learning, 2001
2	Rangaraj M. Rangayyan, ―Biomedical Image Analysis‖, CRC Press, 2005
3	Pratt W.K, ―Digital Image Processing‖, 3rd ed., John Wiley & Sons, 2007
	Jain Anil K., ―Fundamentals Digital Image Processing‖, Prentice Hall India, 2010
Useful links	
1	https://nptel.ac.in/courses/117105079
2	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
3	https://nptel.ac.in/courses/117105135

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Session: 2024-25

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2.To produce competent technocrats of high standards satisfying the needs of all stakeholders.

Program: B.Tech Electronics and Telecommunication Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7E004C	Advanced Digital Signal Processing	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of Signals and Systems, Digital Signal Processing.

Prior Reading Material / useful links	
1	https://nptel.ac.in/courses/117101001
2	https://onlinecourses.nptel.ac.in/noc21_ee20/preview

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	**Represent** discrete-time signals analytically and visualize them in the time domain.
2	CO2	**Summarize** the requirement of theoretical and practical aspects of DSP with regard to sampling and reconstruction.
3	CO3	**Apply** various techniques of filter designs for various applications.
4	CO4	**Analyze** Multi Rate Signal Processing and describe how to apply it for the wavelet transform.
5	CO5	**Evaluate** the Finite word length effects in Fixed point DSP Systems
6	CO6	**Estimate** the power spectral estimation methods.

Syllabus:

Course Contents	
Unit I	**Multirate Digital Signal Processing** Introduction, Review of Decimation and Interpolation, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion. **[6Hours]**
Unit II	**Applications of Multirate Digital Signal Processing** Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals Linear Prediction and Optimum Linear **[4Hours]**
Unit III	**Filters** Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linear prediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters. **[7 Hours]**
Unit IV	**Power Spectral Estimation** Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods **[6Hours]**
Unit V	**Parametric Method of Power Spectrum Estimation** Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Moving Average(MA) and ARMA Models Minimum Variance Method. **[7Hours]**
Unit VI	**Wavelet Transform** Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet, Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets. **[6Hours]**
Text Books	
1	J. G. Proakis & D. G. Manolokis, "Digital Signal Processing – Principles, Algorithms Applications", PHI.
Reference Books	
1	S. M .Kay, "Modern spectral Estimation techniques", PHI, 1997.EmmanuelC. Ifeacher Barrie. W. Jervis, "DSP – A Practical Approach", PearsonEducation.
2	Oppenheim, Alan V. Discrete-time signal processing. Pearson Education India, 1999.
3	Mitra, Sanjit Kumar, and YonghongKuo. Digital signal processing: a computer-based approach. Vol. 2. New York: McGraw-Hill Higher Education, 2006.
Useful links	
1	https://nptel.ac.in/courses/117101001
2	https://onlinecourses.nptel.ac.in/noc21_ee20/preview

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Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7L005	Basic Electronic Simulation Lab	0	0	2	1

Prerequisites for the course	
1	Knowledge of Electronic Components and instruments.

Prior Reading Material / useful links	
1	https://youtu.be/NFXyItNODpQ
2	https://be-iitkgp.vlabs.ac.in/

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	**Develop** the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
2	CO2	**Describe** sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
3	CO3	**Synthesize** Combinational and Sequential circuits on programmable ICs and test the hardware
4	CO4	**Interface** the hardware to the programmable chips and obtain the required output

Syllabus:

	List of Experiments
	PART A
1	Develop a Verilog program for 2 to 4 decoder.
2	Develop a Verilog program for 8 to 3 encoder (without priority & with priority).
3	Develop a Verilog program for 8 to 1 multiplexer
4	Design 4 bit binary to gray converter in Verilog
5	Model in Verilog for a full adder and add functionality to performlogical operations of XOR, XNOR, AND and OR gates.
6	Write a Verilog code to model 32 bit ALU.
7	Write Verilog code for SR, D and JK and verify the flip flop.
8	Write Verilog code for 4-bit BCD synchronous counter.
9	Write Verilog code for counter with given input clock and check whether it works as clock divider performing division of clock by 2, 4, 8 and 16. Verifythe functionality of the code.
	PART-B
1	DevelopaVerilogcodetodesignaclockdividercircuitthatgenerates1/2,1/3rd and 1/4thclock from a given input clock. Port the design to FPGA and validate the functionality through oscilloscope.
2	Interface a DC motor to FPGA and write Verilog code to change its speed and direction.
3	Interface a Stepper motor to FPGA and write Verilog code to control the Stepper motor rotation which in turn may control a Robotic Arm. External switches to be used for different controls like rotate the Stepper motor (i) +N steps if Switch no.1 of a Dip switch isclosed (ii) +N/2 steps if Switch no. 2 of a Dip switch isclosed (iii) –N steps if Switch no. 3 of a Dip switch is closedetc.
4	Interface a DAC to FPGA and write Verilog code to generate Sine wave of frequency F KHz (eg. 200 KHz) frequency. Modify the code to down sample the frequency to F/2 KHz. Display the Original and Down sampled signals by connecting them to an oscilloscope.
5	Write Verilog code using FSM to simulate elevator operation.
6	Write Verilog code to convert an analog input of a sensor to digital form and to display the same on a suitable display like set of simple LEDs, 7-segment display digits or LCD display.

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Semester	Course Code	Name of the course	L	T	P	Credits
VII	ET7L001	Digital Communication Lab	0	0	2	1

Prerequisites for the course	
1	Basic knowledge of Communication System Engineering, error control coding, Digital Communications, Signals and Systems.

Prior Reading Material / useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee11/preview
2	https://nptel.ac.in/courses/117101051

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	Evaluate the performance of PCM, DPCM and Delta modulation schemes.
2	CO2	Implement different digital modulation schemes like FSK, PSK, and DPSK.
3	CO3	Analyze source/channel encoding & decoding methods.
4	CO4	Simulate Pulse Digital Modulation & demodulation using MATLAB.
5	CO5	Simulate digital communication techniques like ASK, FSK & PSK.

Syllabus:

List of Experiments:	
Trainer Kit Based Experiments	
1	Generation and Detection of Pulse Code Modulation for both A.C and D.C signals
2	Generation and Detection of Differential Pulse Code Modulation
3	Generation and Detection of Delta Modulation
4	Generation and Detection of PSK.
5	Generation and Detection of FSK.
6	Generation and Detection of DPSK.
7	Generation and Detection of QPSK.
8	Linear Block code-Encoder and Decoder
9	Convolution code-Encoder and Decoder
10	To study the Spectrum Analyzer
Simulation Based Experiments (Open Source/Matlab/Multisim)	
1	Amplitude Shift Keying
2	Phase Shift keying
3	Time Division Multiplexing
4	Pulse Code Modulation

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Semester	Course Code	Name of the course	L	T	P	Credits
VIII	ET8E001A	5G Wireless Networks	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of Digital and Wireless communication

Prior Reading Material/useful links	
1	https://www.qualcomm.com/5g/what-is-5g#:~:text=A%3A%205G%20is%20based%20on,sub%2D6%20GHz%20and%20mmWave.
2	https://www.techtarget.com/searchnetworking/feature/Understand-the-basics-of-5G-wireless-networks

Course Outcomes: At the end of the course, students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the objectives of 5G
2	CO2	Compare 5G Architecture with 4G Architecture.
3	CO3	Analyze the principles of Softwarization in5G.
4	CO4	Explain the concept of MEC and Fog computing.
5	CO5	Evaluate physical layer design in 5G.
6	CO6	Characterize and analyze network security aspect in 5G.

Syllabus:

Course Contents	
Unit I	**Introduction** 5GPP&NGMN,5GDesignObjectivePart1,5GDesignObjectivePart2,ITU- R IMT-2020 vision for 5G, 5G Spectrum Requirements, Globally Harmonised 5G Spectrum, 5G Industry Progress, 5G Network Perspectives. **[6 Hours]**
Unit II	**Architecture** 5G Scenarios, 5G RAN, 5G Mobile Core and Operating System, 5G Architecture View, 5G Network Slicing, 5G Architecture Plane Part 1, 5G Architecture Plane Part 2, Logical and Functional 5G Architecture, Dynamic CRAN, 5G NR Logical Architecture **[7 Hours]**
Unit III	**Programmability and Softwarization** Network Programmability and Softwarization, Network Programmability. **[5 Hours]**
Unit IV	**Mobile Edge Computing and FOG Computing** MEC Introduction**,** MEC Concept, MEC Architecture, MEC Benefits, Fog Computing. **[5 Hours]**
Unit V	**Radio Access Technologies** Millimeter Wave Propagation, Flexible Physical Layer Design Part 1, Flexible Physical Layer Design Part 2, Distributed Massive MIMO Principles, Energy Transfer for Massive MIMO **[7 Hours]**
Unit VI	**Network Security** 5G Security, 5G Security Goals, 5G New Trust Model, Diversified Identity Management, User Privacy Protection Requirement,5G Core Security,5GRadio Network Security. **[7Hours]**
Text Books	
1	R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies. John Willey & Sons, West Sussex, 2017.
2	Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology.
Reference Books	
1	T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock,, Millimeter Wave Wireless Communication., Pearson Education, 2015.
2	M. Vaezi, Z. Ding, and H. V. Poor,, Multiple Access techniques for 5G Wireless Networks and Beyond., Springer Nature, Switzerland, 2019
Useful linkss	
1	https://onlinecourses.nptel.ac.in/noc21_ee12/preview
2	https://5g.systemsapproach.org/intro.html

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Semester	Course Code	Name of the course	L	T	P	Credits
VIII	ET8E001B	Modern Digital Communication System	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of Digital communication.
2	Basic knowledge about different communication techniques.

Prior Reading Material/useful links	
1	https://www.youtube.com/watch?v=hTAlcrqjNps
2	https://www.egr.msu.edu/~tongli/teaching/ece865/Introduction

Course Outcomes: At the end of the course, students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the principles and theories required to design reliable communication link
2	CO2	Compare different digital communication techniques and judge their applicability and performance in different application scenarios.
3	CO3	Evaluate mathematical modeling to solve problems in wireline and wireless digital communications.
4	CO4	Develop skill set to choose and optimize design parameters [e.g., power distribution, modulation, redundancy, speed] in advanced communication technologies used in the telecommunication industry.
5	CO5	Improve fundamental grounding and sophistication needed to explore topics in Advanced and Emerging wireless communication standards like 4G, 5G and different WLAN that include MIMO, mmWave communication

Syllabus:

Course Contents	
Unit I	**Introduction** Introduction to Digital Communication, Elements of Digital Communication, Mathematical Models for Communication Channels and their characteristics, Review system designing and performance aspects, Networks aspects of digital interface, Historical background and developments in modern digital communication. **[5Hours]**
Unit II	**Mathematical Preliminaries** Signals, LTI system, The Nyquist Sampling theorem, Complex envelope representation, the spectrum of bandpass signal, low pass equivalent of bandpass signal, Energy considerations, low pass equivalent of a band pass system. Signal space representation of waveforms: Vector space concepts, Signal space concepts, Orthogonal expansions of signals, Gram-Schmidt procedure. **[6Hours]**
Unit III	**Digital Modulation Schemes and Optimum Receivers for AWGN Channels** Representation of digitally modulated signals, Multidimensional Signaling, Signaling Schemes with Memory: CPFSK, CPM. Spectral properties of various modulation schemes and their comparison, The Nyquist criterion for ISI avoidance, Optimum Receivers for AWGN Channels: Waveform and Vector Channel models, Optimum reception in AWGN, error probability of band-limited and power limited signaling, detection non-coherent detection. **[8Hours]**
Unit IV	**Carrier and symbol Synchronization** Receiver design requirements, Signal Parameter estimation: Carrier recovery and symbol synchronization in signal demodulation, Carrier Phase estimation, Symbol timing estimation, Joint estimation of Carrier Phase and Symbol timing, Performance characteristics of ML estimators. **[7Hours]**
Unit V	**Information-Theoretic Limits and Channel Coding** The capacity of AWGN Channel: modeling and geometry, Shannon theory basics: entropy, mutual information, and divergence, channel coding theorem, the capacity of standard constellations, parallel Gaussian channels and water filling Channel codes: Binary convolution codes, Turbo codes and iterative coding, LDPC codes, bandwidth-efficient coded modulation. **[7Hours]**
Unit VI	**Digital Modulation for Wireless Communication** Physical modeling for wireless channels, Fading and diversity, OFDM, CDMA,MIMO-linear array, Beam-steering, MIMO-OFDM, Spatial Multiplexing, Space- time Coding . **[6 Hours]**

Text Books	
1	John. G. Proakis, Digital Communications, McGraw Hill
2	Upamanyu Madhow, Fundamentals of Digital Communication, Cambridge University Press, 2012
Reference Books	
1	B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, 4th Ed., 2009
2	J. R. Barry, E. A. Lee, and D. G. Messerschmitt, Digital Communication, Kluwer Academic Publishers, 2004
3	Simon Haykin, "Communication Systems," John Wiley & Sons, 5th Ed., 2009.
Useful links	
1	**https://eng.uok.ac.ir/mohammadkhani/courses/AdvDigitalComm_94_2.html**
2	**https://www.psa.gov.in/technology-frontiers/advanced-communication-technologies/758**

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Semester	Course Code	Name of the course	L	T	P	Credits
VIII	ET8O004	Advanced Processors & Controllers	4	0	0	4

Prerequisites for the course	
1	Basic knowledge of digital circuits.
2	Basic Idea about microprocessors & Microcontrollers and their interfacing.

Prior Reading Material/useful links	
1	https://www.elprocus.com/what-is-digital-circuit-design-and-its-applications/
2	https://www.agner.org/digital/digital_electronics_agner_fog.pdf

Course Outcomes: At the end of the course, students will be able to:

Sr.No	Course outcome number	CO statement
1	CO1	Understand basic concepts of microprocessor 8085.
2	CO2	Explain the hardware architecture of Microprocessor and microcontroller
3	CO3	Analyze Arduino Boards and Components.
4	CO4	Develop simple assembly language programs.
5	CO5	Design practical applications of different processors.

Syllabus:

Course Contents	
Unit I	**Introduction to 8085** Microprocessor systems with bus organization, Microprocessor Architecture & Operations,Memory,I/ODevice,MemoryandI/OOperations,Introductionto8085 assembly language programming, 8085 Microprocessor Architecture and its operation, Address, Data and Control Buses, Pin Functions, De-multiplexing of Buses, Generation Of Control Signals. Assembly Language Programming Basics, Introduction to 8085 instructions, Addressing Modes, Writing, Assembling & executing a Program. **[10 Hours]**
Unit II	**Introduction to 8051** Microcontrollers:MicroprocessorsandMicro-controllers,8051controller,Block Diagram &Architecture. 8051 Instruction Set, Addressing modes & introduction to programming. 8051 Timers, Serial I/O,Interrupts. **[8Hours]**
Unit III	**ARM Processors** ARM Micro-controllers – overview; features, ARM 7 – architecture, Thumb, Register Model, Addressing modes. The RISC design philosophy, ARM design philosophy, embedded system hardware- AMBA bus protocol, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics. Fundamentals of ARM instructions, Barrel shifter. Advantages & Disadvantages of ARM processors. **[8Hours]**
Unit IV	**Arduino** Introduction to Arduino, Architecture, Advantages, Versions of Arduino, Characteristics and layout of UNO, Introduction to Arduino IDE software, Introduction to sensors and actuators. Case study example. **[7 Hours]**
Unit V	**Introduction to Raspberry Pi** Introduction to Raspberry Pi ,OS for Raspberry Pi, Raspberry Pi processor, Versions of Raspberry pi models, Hardware components of Raspberry Pi3,Case study of IoT Applications based onRaspberryPi. **[8Hours]**
Unit VI	**Applications of 8085 & 8051** Case study: Traffic Controller using 8085 Microprocessor, Temperature Control Using 8051 Microcontroller, ARM Cortex [STM32] based Solar Street Light, Arduino Based Home Automation System, Quadcopter using Raspberry Pi. **[7 Hours]**
Text Books	
1	Steve Heath, “Embedded System Design” Butterworth Helnemann.
2	Kenneth J. Ayala “The 8051 Micro-controller
3	Architecture, Programming & Applications”, Second Edition, Penram International & Thomson Asia.
4	John B. Peatman, “Design with PIC Micro- controllers”, Low Price Edition, Pearson Education
5	Microprocessor Architecture, Programming & Applications, by Goankar, 6th Edition 2013
6	Fundamentals of Microprocessor and Microcontrollers, by B.Ram, DhanpatRai Publications, 9th edition 2019.

7	Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, January 2012, McGraw Hill Professional
Reference Books	
1	ARM System Developer’s guide –Andrew N. Sloss, Elsevier Publications, ISBN 978-81-8147- 646-3, 2016
2	ARM Assembly Language – William Hohl, CRC Press, ISBN:978-81-89643-04-1
3	ARM System-on-chip Architecture by Steve Furber, Pearson Education, ISBN978-81- 317-0840-8, 2E,2012
4	LPC 2148 User Manual
5	Embedded Systems: A Contemporary Design Tool- James K. Peckol ISBN: 978-0-471- 72180-2 October 2007, ©2008
6	Eben Upton and Gareth Halfacree, “Raspberry Pi User Guide”, August 2016, 4th edition, John Wiley & Sons
7	Alex Bradbury and Ben Everard, “Learning Python with Raspberry Pi”, Feb 2014, JohnWiley& Sons
8	Michael Margolis, “Arduino Cookbook”, First Edition, March 2011, O'Reilly Media, Inc
Useful links	
1	https://www.raspberrypi.org/magpiissues/Projects_Book_v1.pdf
2	https://www.sim8085.com/
3	http://www.edsim51.com/
4	https://nptel.ac.in/courses/117104072
5	https://archive.nptel.ac.in/content/storage2/courses/106108100/pdf/Lecture_Notes/LNm1.pdf
6	https://ict.iitk.ac.in/courses/learn-iot-through-arduino-and-raspberry-pi/