|  |
| --- |
| KERALA TECHNOLOGICAL UNIVERSITY  http://ktu.edu.in/images/logo_final.png  **SCHEME AND SYLLABUS**  **FOR**  **M. Tech. DEGREE PROGRAMME**  **IN**  **ELECTRONICS AND COMMUNICATION ENGINEERING**  **WITH SPECIALIZATION**  **ADVANCED COMMUNICATION AND INFORMATION SYSTEMS**  **CLUSTER 05 (ERNAKULAM II)**  **KERALA TECHNOLOGICAL UNIVERSITY CET Campus, Thiruvananthapuram Kerala, India -695016**  **(2015 ADMISSION ONWARDS)** |

**KERALA TECHNOLOGICAL UNIVERSITY**

**SCHEME AND SYLLABUS FOR M. Tech. DEGREE PROGRAMME**

**Branch: ELECTRONICS AND COMMUNICATION ENGINEERING**

**Specialization: ADVANCED COMMUNICATION AND INFORMATION SYSTEMS**

**SEMESTER – I**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exam**  **Slot** | **Course**  **No.** | **Name** | **L-T-P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Hrs** |
| A | 05EC6101 | Core-Linear Algebra | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05EC6103 | Core-Advanced Optical Communication Systems | 3-1-0 | 40 | 60 | 3 | 4 |
| C | 05EC6105 | Core- Queuing Theoryand Communication Networks | 3-1-0 | 40 | 60 | 3 | 4 |
| D | 05EC6107 | Core- Probability and Random Processes | 2-1-0 | 40 | 60 | 3 | 3 |
| E | 05EC611x | Elective I | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05EC6177 | Research Methodology | 1-1-0 | 100 | 0 | 0 | 2 |
|  | 05EC6191 | Lab- Communication systems lab | 0-0-2 | 100 | 0 | 0 | 1 |
| Total | | |  | | | | 21 |

|  |  |
| --- | --- |
| **Elective – I (**05EC61xx**)** | |
| **Course No** | **Subjects** |
| 05EC6111 | Coding Theory |
| 05EC6113 | Pattern Recognition |
| 05EC6115 | Image and Video processing |
| 05EC6117 | RF MEMS |

**SEMESTER – II**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exam**  **Slot** | **Course**  **No.** | **Name** | **L-T-P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Hrs** |
| A | 05EC6102 | Core-Multirate signal Processing and wavelets | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05EC6104 | Core-Advanced Digital Communication | 2-1-0 | 40 | 60 | 3 | 3 |
| C | 05EC6106 | Core-Wireless Communications | 2-1-0 | 40 | 60 | 3 | 3 |
| D | 05EC612x | Elective II | 2-1-0 | 40 | 60 | 3 | 3 |
| E | 05EC613x | Elective III | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05EC6166 | Seminar I | 0-0-2 | 100 | 0 | 0 | 2 |
|  | 05EC6188 | Mini Project | 0-0-4 | 100 | 0 | 0 | 2 |
|  | 05EC6192 | Lab-Communication systems and Networking lab | 0-0-2 | 100 | 0 | 0 | 1 |
| Total | | |  | | | | 21 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Elective – II(**05EC612x**)** | | | **Elective – III (**05EC613x**)** | | |
| **Course No** | **Subjects** | | **Course No** | | **Subjects** |
| 05EC6122 | | Principles of Secure Communication | | 05EC6132 | RADAR Communication Systems |
| 05EC6124 | | Mobile Computing | | 05EC6134 | Optimization Techniques |
| 05EC6126 | | Speech Technology | | 05EC6136 | MIMO Communication Systems |
| 05EC6128 | | Multicarrier Communication Systems | | 05EC6138 | Spread Spectrum and CDMA Systems |

**SEMESTER – III**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exam**  **Slot** | **Course**  **No.** | **Name** | **L-T-P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Hrs** |
| A | 05EC714x | Elective IV | 2-1-0 | 40 | 60 | 3 | 3 |
| B | 05EC715x | Elective V | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05EC7167 | Seminar II | 0-0-2 | 100 | 0 | 0 | 2 |
|  | 05EC7187 | Project  (Phase I) | 0-0-12 | 50 | 0 | 0 | 6 |
| Total | | |  | | | | 14 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Elective – I V(**05EC714x**)** | | **Elective – V (**05EC715x**)** | |
| **Course No** | **Subjects** | **Course No** | **Subjects** |
| 05EC7141 | Soft Computing Techniques | 05EC7151 | Signal Compression |
| 05EC7143 | Adaptive Filters & Systems | 05EC7153 | Estimation & Detection Theory |
| 05EC7145 | FPGA based system design | 05EC7155 | Remote sensing |
| 05EC7147 | Network Administration | 05EC7157 | System design using ARM |

**SEMESTER – IV**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Exam**  **Slot** | **Course**  **No.** | **Name** | **L-T-P** | **Internal Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Hrs** |
|  | 05EC7188 | **Project(Phase2)** | **0-0-21** | **70** | **30** | **-** | **12** |
| **Total** | | |  | | | | **12** |

**L**‐Lecture;  **T**‐Tutorial;  **P**‐Practical

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6101** | | **LINEAR ALGEBRA** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To provide the necessary Mathematical foundation needed for the subjects to be dealt with in the program. * To develop the ability to use the concepts of Linear algebra and Special functions for solving problems related to Networks. * To formulate and construct a mathematical model for a linear programming problem in real life situation   **COURSE OUTCOMES:**   * After the completion of the course, the student should have a thorough understanding of Linear Algebra, Random Processes and their applications.   **SYLLABUS:** | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Matrices:** Introduction to linear system, matrices, vectors, Gaussian elimination, matrix notation, partitioned matrices, multiplication of partitioned matrices, inverse of partitioned matrices, triangular factors and row exchanges (LU, LDU), row exchanges and permutation matrices, inverses (Gauss-Jordan method) | | | | 10 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Vector spaces:** Vector space, subspace, linear independence, span, basis, dimension, spanning set theorem, null space, column space, row space-(Matrix), basis and dimension of null space, column space, row space-(Matrix), rank nullity theorem, co-ordinate system, change of basis–(finite space) | | | | 8 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Linear transformation:** Linear transformation, Kernel and range of linear transformation, matrix representation of linear transform, inverse transform  **Inner product spaces:** Inner product space, norm, Cauchy-Schwarz inequality, Triangular inequality, self adjoint and normal operators, orthogonality, Hilbert spaces, orthogonal complements, projection theorem, orthogonal projections, orthonormal basis, Gram-Schmidt orthogonalization. | | | | 10 |
| **IV** | **Selected topics:** Eigen values, eigen vectors, diagonalization, symmetric matrices, quadratic forms, classification of quadratic forms, least-square solution of inconsistent system, singular value decomposition. | | | | 8 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. K. Hoffman, R. Kunz, “Linear Algebra”, Prentice Hall India 2. D. C. Lay, “Linear algebra and its applications”, Pearson 3. G. Strang, “Linear algebra and its applications”, Thomson 4. Gareth Williams, “Linear algebra with applications”, Narosa 5. Michael W. Frazier, “An Introduction to wavelets through linear algebra”, Springer. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6103** | | **ADVANCED OPTICAL COMMUNICATION SYSTEM** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:  Students are introduced to:   * Different light wave system components and their design and different types of budget analysis for light wave systems. * Single and multimode light wave propagation in step, graded index fibres and various dispersion mechanisms,Coherent (LASER) and incoherent (LED) optical sources. * Detailed description of different optical amplifiers and soliton based communication systems.   **COURSE OUTCOMES:**   * Students will be able to apply the knowledge of advanced principles to the analysis of basic optical networks. * Students should also have the ability to analyze, model and implement advanced optical communication systems.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | **Light wave system components:** Optical fibers, wave propagation, single mode and multi mode fibers, dispersion in fibers.  **Optical transmitters:** LED and semiconductor LASER, characteristics, transmitter design.  **Optical receivers:** Common photo detectors. receiver design, receiver noise and sensitivity | | | | 10 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Light wave system architecture:** Design, loss limited and dispersion limited, power budget and rise time budget, long haul systems, performance limiting factors, terrestrial light wave system, under sea light wave systems. | | | | 8 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Optical amplifiers:** Gain spectrum, amplifier noise, amplifier specifications, semiconductor optical amplifiers, amplifier design characteristics, pulse amplifier, system application, Raman amplifiers, EDFA, gain spectrum, amplifier noise, multichannel amplification, distributed gain amplifier, dispersion management, pre-compensation schemes, post compensation technique, dispersion compensation fibers. | | | | 10 |
| **IV** | **Soliton Systems**: Fiber solitons, nonlinear Schrodinger equation, bright soliton, dark solitons, soliton based communications, information transmission with solitons, soliton interaction, loss managed soliton, dispersion managed solitons, impact of amplifier noise, high speed soliton system. | | | | 8 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Govind P. Agrawal, “Fiber Optic Communication System”, John Wiley and Sons, 2003 2. J Diggonet, “Rare Earth Doped Fiber Lasres and Amplifiers” 3. Hasegawa, “Solitons in Optical Communications” 4. Govind P. Agrawal, “Nonlinear Optics”, Academic press 2nd Ed. | | | | | |
|  | | | | | |
|  | | | | | |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6105** | | **QUEUEING THEORY & COMMUNICATION NETWORKS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * This course provides deep knowledge on Internet architecture, Quality of service issues in broad band networks and Statistical multiplexing of communication networks. * Students will learn how to model and evaluate network systems, switches, routers, etc. * Queuing theory examines every component of waiting in line to be served, including the arrival process, service process, number of servers, number of system places and the number of customers.   **COURSE OUTCOMES:**  A student who successfully fulfils this course will have:   * Ability to understand and analyze the issues with host naming, addressing, and routing packets in networks-of-networks (internetworks). * Ability to develop a simple network simulator to analyze the TCP protocol performance under limited network resources. * Ability to understand and analyze the issues in providing quality-of-service for networked multimedia applications, such as internet telephony.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36hrs) | | | | HRS |
| **I** | **Applications and Layered architecture:** OSI model and TCP/IP architecture. Application protocols: Name Services (DNS), Electronic mail, SNMP, Transmission system and telephone networks. Multiplexing, SONET, WDM. Telephone network signalling. Traffic overload control in Telephone network. | | | | 10 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Local Area Networks and Medium Access Control Protocols:** LAN, Random Access. Scheduling approach to MAC, LAN standards, LAN bridges.  **Packet Switching:** Routing, shortest path algorithms, ATM, Traffic management, QoS, Congestion Control. | | | | 10 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **TCP/IP:** TCP/IP architecture, IP: Packet, Addressing, routing CIDR, RAR, ICMA, IPV4/IPV6, UDP, DHCP and Mobile IP, Internet routing protocol: open shortest path, Multicast routing: reverse path and distance vector.  **Advanced Network Architecture:** IP forwarding architecture, RSVP. | | | | 9 |
| **IV** | **Delay models in data networks:** Queuing models: Little’s Theorem, M/M/1 queuing system, M/M/m, M/M/∞, M/M/m/m and other Markov systems, M/G/1 system, Network of transmission lines, Network of Queues. | | | | 7 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Alberto Leon-Garcia, Indra Widjaja “Communication Networks, Fundamental Concepts and Key applications”, 2/e, Tata McGraw-Hill, 2003 2. L. L. Peterson, B. S. Davie, “Computer Networks: A System Approach”, 4/e, Elsevier, 2007 3. Jean Walrand, PravinVaraiya, “High Performance Communication Networks”,   2/e, Morgan Kaufman Publishers, 2000.   1. A. Behrouz Forouzan, “Data Communications & Networking”, Tata McGraw-Hill, 2006 2. Dimitri P. Bertsekas, Robert G. Gallager, “Data Networks," 2/e, Prentice Hall. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6107** | | **PROBABILITY ANF RANDOM PROCESSES** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * This course provides a theoretical background on the subjects of probability and random processes with a focus on the application to problems in engineering and science. * The objective is for the student to develop a conceptual understanding of the type of problems that require probabilistic analysis and learn methods for formulating and analyzing the problem.   **COURSE OUTCOMES:**  Students will have:   * Skill to convert a real problem to a probability model. * Knowledge in random systems which are helpful to analyze communication, control, and signal processing systems. * Knowledge on behaviour, modelling and analysis of random processes and signals.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Introduction to Probability Theory:** Sample space and events, conditional probabilities, independent events, the law of total probability and Bayes’ theorem.  **Random variables :** Discrete and continuous random variables, distributions-binomial, poisson, Gaussian, uniform, exponential, expectation of a random variable, joint probability distributions, marginal probability distributions and random vectors, moment generating function-binomial, poisson, Gaussian, uniform, Exponential, joint probability distributions. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Limit theorems**: Markov and Chebyshev inequalities, weak and strong law of large numbers, convergence concepts and central limit theorem.  **Stochastic process** -definition, conditional probability distributions- continuous and discrete cases, computing mean and variances by conditioning. | | | | 6 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Random Process:**  Classification of random process, special classes of random process, SSS and WSS, auto and cross–correlation, ergodicity, Mean ergodic process, power spectral density, response of a LTI system to WSS input. | | | | 7 |
| **IV** | **SelectedTopics:**  Poisson process-Properties, Markov process and Markov chain, Chapman-Kolmogorov theorem, classification of states of a Markov chain. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. T. Veerarajan, “Probability, Statistics and random processes”, McGraw-Hill 2. S. M. Ross, “Stochastic Process”, John Wiley and sons 3. V. Sundarapandian, “Probability, statistics and Queueing theory”, Prentice Hall of India 4. Athanasios Papoulis, S. Unnikrishnan Pillai, “Probability, Random Variables and Stochastic Processes”, Tata Mc GrawHill 5. Henry Stark, John W. Woods, “Probability and random processes with application to signal processing”, Pearson Education | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6111** | | **CODING THEORY** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To introduce information theory, the fundamentals of error control coding techniques. * To study algebraic codes, convolutional codes, and modern graph based codes. * To understand theoretical framework upon which error-control codes are built.   **COURSE OUTCOMES:**  At the end of the course students will have knowledge in:   * Basic notions of information and channel capacity. * Convolutional and block codes and decoding techniques. * How error control coding techniques are applied in communication systems.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Introduction to Communication systems and Information theory:** information sources and channels, detection and correction of errors, Shannon limit.  **Source Coding**:- instantaneous codes, Kraft inequality and McMillian’s Theorem, average length and compact codes, perfect codes, Huffman codes, arithmetic code, data compression | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Algebraic Coding:** error detection, correction and decoding, linear block codes, Hamming and Golay codes, Reed Muller codes, cyclic codes, BCH (Bose Chaudhuri Hocquenghem) codes, Reed Solomon codes, Quadratic residue codes, Alternating codes, Berlekamp-Massey-Sugiyama and Peterson-Gorenstein-Zierler decoders for alternating codes, the Meggitt decoder for cyclic codes. | | | | 8 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Convolutional Codes:** encoding of convolutional codes, decoding: trellis diagram and Viterbi algorithm, convolutional codes in mobile communications. | | | | 6 |
| **IV** | **Turbo Coding:** LDPC codes: Geometric Construction of LDPC codes- Euclidean Geometry (EG)-Type I &Type II , Projective Geometry(PG )- Type I & Type II. Code concatenation: Single level concatenated codes, Multi level concatenated codes, concatenated convolution codes, Interleavers | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. S. Lin, D. J. Costello Jr,. “Error Control Coding: Fundamentals and Applications,” Prentice-Hall, 2004 2. Ranjan Bose. “Information Theory, Coding and Cryptography, Second Edition, McGraw Hill Education 3. Neubauer, J. Freudenberger, V. Kuhn. “Coding Theory: Algorithms, Architectures and Applications,” John Wiley & Sons, 2007 4. S. Ling, C. Xing. “Coding Theory: A First Course,” Cambridge University Press, 2004 5. R. Togneri, C. J. S. deSilva. “Fundamentals of Information Theory and Coding Design” CRC Press, 2006 6. Justesen, J. Hoeholdt, T., “A course in error-correcting codes”, European Math. Soc., 2004. 7. Proakis J. G., Salehi M., “Communication Systems Engineering”, Prentice-Hall, 2002. 8. Lint Van J. H., “Introduction to Coding Theory”, Springer Verlag, 1999. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6113** | | **PATTERN RECOGINITION** | **2-1-0-3** | 2015 | |
| COURSE OBJECTIVES:   * To equip the students with basic mathematical and statistical techniques commonly used in pattern recognition. * To acquire adequate background on probability theory, statistics, and optimization theory to tackle the wide spectrum of engineering problems. * To introduce variety of pattern recognition algorithms in the context of real world problems.   **COURSE OUTCOMES:**  At the end of the course students will have:   * Knowledge in pattern recognition and machine learning theories. * Ability to design and implement pattern recognition techniques. * Capability to apply the pattern recognition theories in the field of interest.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction - features, feature vectors and classifiers, Supervised versus unsupervised pattern recognition. Classifiers based on Bayes Decision theory- introduction, discriminant functions and decision surfaces, Bayesian classification for normal distributions, Estimation of unknown probability density functions, the nearest neighbour rule. Linear classifiers, Linear discriminant functions and decision hyper planes, The perceptron algorithm. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Gaussian mixture models, expectation maximization. Non-Linear classifiers- Two layer and three layer perceptrons, Back propagation algorithm, Radial Basis function networks. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Non-Linear classifiers- Support Vector machines-nonlinear case, Decision trees, combining classifiers, Feature selection, Receiver Operating Characteristics (ROC) curve, Class separability measures, Optimal feature generation, The Bayesian information criterion, Dimension reduction technique: PCA, FDA. | | | | 6 |
| **IV** | Clustering- Cluster analysis, Proximity measures, Clustering Algorithms - Sequential algorithms, Hierarchical algorithms - Agglomerative algorithms, Divisive algorithms. K - means algorithm. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Richard O. Duda and Hart P.E, and David G Stork, Pattern classification , 2nd Edn., John Wiley & Sons Inc., 2001 2. Sergios Theodoridis, Konstantinos Koutroumbas, “Pattern Recognition”, Academic Press, 2006. 3. Earl Gose, Richard Johnsonbaugh, and Steve Jost; Pattern Recognition and Image Analysis, PHI Pvt. Ltd., NewDelhi-1, 1999. 4. Fu K.S., Syntactic Pattern recognition and applications, Prentice Hall, Eaglewood cliffs, N.J., 1982 5. Andrew R. Webb, Statistical Pattern Recognition, John Wiley & Sons, 2002. 6. Christopher M Bishop, Pattern Recognition and Machine Learning, Springer 2007. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6115** | | **IMAGE AND VIDEO PROCESSING** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * This course imparts a detailed knowledge of modelling of speech signals, sub band coding of speech, vocoders, Homomorphic speech processing, Voice morphing, speaker identification and speaker recognition systems, and processing of music..   **COURSE OUTCOMES:**   At the end of the course, students will be:   * Able to disseminate high level research results and engineering developments so that researchers could build further on that. * Able to present practical solutions for real time signals, Image and Video Processing problems in Engineering and Science.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction To Digital Image Processing & Applications ,Elements Of Visual Perception-Mach Band Effect-,Sampling, Quantization, Basic Relationship Between Pixels, Color Image Fundamentals-RGB-HSI Models, Image Transforms-Two Dimensional Orthogonal And Unitary Transforms ,Separable Unitary Transforms -Basis Images, DFT, WHT, KLT, DCT And SVD. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Image Enhancement - Filters In Spatial And Frequency Domains, Histogram-Based Processing, Homomorphic Filtering. Image Restoration: Degradation Models, PSF, Circulant And Block - Circulant Matrices, Deconvolution, Restoration Using Inverse Filtering, Wiener Filtering And Maximum EntropyBased Methods. Image Segmentation: Pixel Classification, Bi-Level Thresholding, Multilevel Thresholding, Adaptive Thresholding, Spectral & Spatial Classification,Edge Detection, Hough Transform, Region Growing. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Representation- Boundary Representation: Chain Codes- Polygonal Approximation – Boundary Segments – Boundary Descriptors - Regional Descriptors–Relational Descriptors- Object Recognition-Pattern And Pattern Classes-Recognition Based On Decision Theoretic Methods-Matching-Optimum Statistical Classifiers-Structural Methods-Matching Shape Numbers-String Methods. Morphological Image Processing-Erosion And Dilation, Opening Or Closing, HIT Or MISS Transformation, Basic Morphological Algorithms, Grey Scale Morphology. | | | | 6 |
| **IV** | Video Processing - Display Enhancement, Video Mixing, Video Scaling, Scan Rate Conversion, Representation Of Digital Video, Spatio-Temporal Sampling; Video Compression-Motion Estimation, Intra And Interframe Prediction, Perceptual Coding, Standards - MPEG, H.264. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. A. K. Jain, Fundamentals Of Digital Image Processing, Prentice Hall Of India, 1989.  2. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education.  3. Iain E Richardson, H.264 And MPEG-4 Video Compression, John Wiley & Sons, September 2003  4. A. M. Tekalp, Digital Video Processing , Prentice-Hall  5. A Bovik, Handbook Of Image & Video Processing, Academic Press, 2000  6. W. K. Pratt, Digital Image Processing, Prentice Hall  7. A. Rosenfeld And A. C.Kak, Digital Image Processing,Vols. 1 And 2, Prentice Hall.  10. K.R.Rao, Zoran.SBojkovic, Dragorad A Milovanovic, MultimediaCommunication Systems: Techniques ,Standards And Networks , Prentice Hall | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6117** | | **RF MEMS** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * This course focuses on the modelling, design, technology and applications of RF Micro-Electro-Mechanical Systems (MEMS). * Students will develop a strong understanding of RF MEMS technology and its applications on the future generation of communication systems, radars and sensors   **COURSE OUTCOMES:**  A student who successfully fulfils the course will have demonstrated:   * An understanding of simple linear and non-linear mechanical, electromagnetic and electromechanical models of RF MEMS structures. * An ability to design practical RF MEMS devices using analytical and numerical techniques. * An ability to design high-performance circuits and sub-systems using RF MEMS components and an understanding of the limitations of the RF MEMS technology for wireless applications.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | RF MEMS relays and switches. Switch parameters. Actuation mechanisms. Bistable relays and micro actuators. Dynamics of switching operation. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | MEMS inductors and capacitors. Micromachined inductor. Effect of inductor layout. Modelling and design issues of planar inductor. Gap tuning and area tuning capacitors. Dielectric tuneable capacitors. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Micromachined RF filters. Modelling of mechanical filters. Electrostatic comb drive. Micromechanical filters using comb drives. Electrostatic coupled beam structures.  MEMS phase shifters. Types Limitations Switched delay lines. Micromachined transmission lines. Coplanar lines.Micromachined directional coupler and mixer | | | | 8 |
| **IV** | Micromachined antennas. Microstrip antennas – design parameters. Micromachining to improve performance. Reconfigurable antennas. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. V.K.Varadanetal, RF MEMS and their Applications, Wiley,2003. 2. H.J.D.Santos, RF MEMS Circuit Design for Wireless Communications, Artech House ,2002. 3. G.M.Rebeiz , RF MEMS Theory , Design and Technology, wiley , 2003. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6177** | | **RESEARCH METHODOLOGY** | 1-1-0-2 | 2015 | |
| **COURSE OBJECTIVES:**   * To familiarize the students with different stages of research process. * To get an idea about descriptive and inferential statistics. * To familiarize the students with the nature of research and scientific writing.   **COURSE OUTCOMES:**   * The students should be able to understand the basic concepts of research and its methodologies. * Students are able to understand different statistical test and parameters. * The student should be able to define appropriate research problem and write a research report.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (18hrs) | | | | HRS |
| **I** | **Introduction to research methodology**. Types of research, research methods Vs methodology - stages of research process. Literature review – Problem definition- Research design for exploratory, descriptive and experimental research – Brief introduction to completely randomized design, randomized block design and Latin square designs (description only). | | | | 4 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Sampling fundamentals** -Types of sampling: probability and non-probability sampling. Sampling theory, sampling distribution and sample size determination. **Tools and techniques of data collection**: Questionnaire and schedule for field surveys, interview, observation, simulation, experimental and case study methods. Collection, recording, editing, coding and scaling of data. | | | | 5 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Descriptive and inferential statistics** - Data analysis and interpretation –testing of hypothesis, testing of population mean, variance and proportion –Z test – t test – F test - chi square test- Testing goodness of fit. . Test for correlation and regression, standard error of the estimate. | | | | 4 |
| **IV** | Meaning of interpretation and inference: importance and care for interpreting results. **Presentation of reports:** popular reports and technical reports - structure and style. **Oral and written presentations**: Parts of a research report. Guidelines for writing research papers and reports – Introduction, Methodology, Results, Discussion, Conclusion, Abstract – Writing the title. Methods of giving references and appendices: referencing styles. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. C. R. Kothari, Research Methodology, Methods and techniques (New Age International Publishers, New Delhi, 2004). 2. R. Panneerseklvam, Research Methodology (Prentice Hall of India, New Delhi, 2011). 3. Ranjit Kumar, Research Methodology, A step by step approach (Pearson Publishers, New Delhi, 2005. 4. Management Research Methodology : K. N. Krishnaswami, Appa Iyer and M Mathirajan, Pearson Education, Delhi, 2010 5. Hand Book of Research Methodology : M N Borse, Sree Nivas Publications, Jaipur, 2004 6. Business Research Methods: William G Zikmund, South – Western Ltd, 2003 7. Research Methods in Social Science: P K Majumdar, Viva Books Pvt Ltd, New Delhi, 2005 8. Analyzing Quantitative Data: Norman Blaikie, SAGE Publications , London, 2003 9. SPSS for Windows: Pearson Education New Delhi, 2007 | | | | | |
|  | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC6191** | **COMMUNICATION SYSTEMS LAB** | 0-0-2-1 | 2015 |
| **OBJECTIVES** :  This course is designed   * To impart practical knowledge about how to generate a waveform. * To simulate different modulation and demodulation techniques and convolution coding and decoding.. * To implement different amplitude modulation techniques and coherent detection. * To develop knowledge on PN sequence and to develop knowledge on how to generate PAM and QAM. * To implement BPSK Modulation and Demodulation.   **OUTCOME:**  Students will be able to   * Compute the bandwidth and transmission power by analyzing time and frequency domain spectra of signal required under various modulation schemes. * Apply suitable modulation schemes and coding for various applications. * Identify and describe different techniques in modern digital communications, in particular in source coding, modulation and detection, carrier modulation, and channel coding. * Analyze digital modulation techniques by using signal processing tools. | | | |
| LIST OF EXERCISES / EXPERIMENTS | | | |
| 1. Generation of Sine wave  2. Amplitude Modulation and Demodulation  3. DSBSC Amplitude Modulation and Coherent Detection  4. SSB Amplitude Modulation and Coherent Detection  5. Frequency Modulation and Demodulation  6. Pseudo-Random Binary Sequence Generation(Scrambling and Descrambling)  7. Generation of PAM signal and Eye Diagram  8. QAM  9. Near-End Echo Canceller  10. Far-End Echo Canceller  11. BPSK Modulation and Demodulation  12. Convolution coding and decoding | | | |
| **REFERENCE:**   1. Steven A. Tretter, “Communication System Design Using DSP Algorithms with laboratory experiments for the TMS320C6713 DSK”, Springer, 2008 2. Rulph Chassaing, “Digital Signal Processing and Applications with the C6713 and C6416 DSK”, Wiley, 2005 | | | |
|  | | | |

**SEMESTER II**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6102** | | **MULTIRATE SIGNAL PROCESSING AND WAVELETS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To provide in-depth treatment on methods and techniques used in multirate signal processing. * To provide a clear idea about different types of filter banks implementation, importance of wavelets and various applications of wavelet theory. * This course emphasizes intuitive understanding and practical implementations of the theoretical concepts.   **COURSE OUTCOMES:**  Upon completion of the course, the students will:   * Be able to design multirate DSP system * Understand different methods and applications of multirate DSP * Understand different types of filter banks, their implementation and computational complexity. * Be familiar with different types of wavelets and their applications.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36hrs) | | | | HRS |
| **I** | **Fundamentals of Multi rate Digital Signal Processing :** Basic sampling rate alteration devices-Sampling rate reduction by an integer factor: Down sampler - Time and frequency domain characterization of downs ampler – Anti-aliasing filter and decimation system – Sampling rate increase by an integer factor: Up sampler –Time and frequency domain characterization of up sampler – Anti-imaging filter and interpolation system – Gain of anti-imaging filter – Changing the sampling rate by rational factors –-Multi rate identities - Direct and Transposed FIR structures for interpolation and decimation filters – The Poly phase decomposition – Poly phase implementation of decimation and interpolation. | | | | 10 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Filter banks:** QMF filter banks – Two channel SBC filter banks – Subband coding of speech signals- Standard QMF banks – Filter banks with PR – Conditions for PR – Conjugate Quadrature filters – Paraunitary filter banks – Paraunitary systems – Paraunitary modulation matrix – Spectral factorization – Realization with Lattice structures –Transmultiplexer filter banks – Uniform M channel filter banks – Tree structured filter banks. | | | | 10 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Short time Fourier Transform and Wavelets:** Filtering interpretation of STFT – Filter bank implementation - Time frequency resolution tradeoff –Sampling of STFT in time and frequency - Motivation for Wavelet transform - The Continuous Wavelet Transform - scaling - shifting – Filtering view – Inverse CWT– Discrete Wavelet transform – Filter bank implementation – Inverse DWT | | | | 8 |
| **IV** | **Multiresolution formulation of Wavelet systems and Wavelet applications:** Scaling function and wavelet function –Filter banks and the DWT - Analysis – from fine scale to coarse scale – Analysis tree – Synthesis – from coarse scale to fine scale – Synthesis tree – Wavelet packets –Application of wavelet theory in signal denoising, image and video compression – Application to communication – OFDM multicarrier communication, Wavelet packet based MCCS. | | | | 8 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. R E Crochiere, L E Rabiner, “Multirate Digital Signal Processing”, Prentice Hall. 2. P PVaidyanathan, “Multirate Systems and Filter Banks”, Pearson Education. 3. N J Fliege, “Multirate Digital Signal Processing”, Wiley Inter Science. 4. S K Mitra,”Digital Signal Processing: A computer based approach”, Tata-McGraw Hill 5. A V Oppenheim, R W Shaffer, “Discrete time Signal Processing”, Pearson Education. 6. C S Burrus, R A Gopinath, H Guo, “Introduction to Wavelets and WaveletTransforms: A primer”, Prentice Hall. 7. J C Goswami, A K Chan, “Fundamentals of Wavelets: Theory, Algorithms and Applications”, Wiley Inter Science. G Strang and T Q Nguyen, “Filter banks and Wavelets”, Wellesly Cambridge press. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6104** | | **ADVANCED DIGITAL COMMUNICATION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * The course presents characterization of different communication systems and channels applicable for a wide range of communication applications. Different digital modulation schemes have been thoroughly covered in this subject. * A module on optimum receiver design for Additive White Gaussian Noise (AWGN) channels has been included. Communication through band limited channels and different equalization algorithms have been covered in detail.   **COURSE OUTCOMES:**  Upon completing this course the student should be able to   * Understand the characterization of different communication channels. * Capture different representations of digital communication systems and also study different modulation techniques. * Understand how to design optimum receiver for AWGN channel. * Understand different equalization algorithms.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Characterization of Communication signals and systems:** Elements of digital communication systems, performance , communication channels and their characteristics, mathematical models for communications channels, Representation of band pass and low pass signals , Signal space representation of waveforms:vector space concepts, signal space concepts, Gram- Schmidt procedure, limit theorems for sum of random variables. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Digital modulation schemes :** Representation of digitally modulated signals,memoryless modulation methods: PAM, PSK, QAM, Multidimensional signalling; orthogonal signalling, FSK, biorthogonalsignalling, signalling schemes with memory: CPFSK, CPM, Power spectrum of digitally modulated signals: PSD of digitally modulated signal with memory, PSD of CPFSK and CPM. | | | | 8 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Optimum receivers for AWGN Channels:** Waveform and vector channel models:optimal detection for a general vector channel, MAP and ML, receiver, decisionregions, errorprobability, sufficient statistics. Waveform and vector AWGN channels, optimal detection for the vector AWGN channel, Implementation of optimum receiver for AWGN channels: The correlation receiver,The matched filter receiver. | | | | 5 |
| **IV** | **Communication through Band Limited Channels :-**Characterization of band limited channels, Signal design for band limited channels. Design of band limited signals for no ISI-The Nyquist criterion, Design of band limited signal with controlled ISI-Partial response signaling, Optimum receiver with ISI & AWGN: optimum maximum likelihood receiver, A discrete time model for a channel with ISI. Maximum-Likelihood Sequence Estimation(MLSE) for a discrete time white noise filter model detectors, Adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm(LMS), Recursive Least Squares Algorithms(RLS), blind equalization. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. J. Proakis, “Digital Communications”, McGraw Hill, 4th Edition,2007 2. Bruce Carlson, Crilly&Rutledge, Communication systems, McGraw Hill 3. B. Sklar, "Digital Communications: Fundamentals and Applications", Prentice Hall. 4. John R. Barry, Edward A. Lee, David G. Messerschmitt, "Digital Communication" Kluwer Academic 5. J. M. Wozencraft, I. M. Jacobs,"Principles of Communication Engineering",John Wiley, U. Madhow, "Fundamentals of Digital Communication," Cambridge University Press | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6106** | | **WIRELESS COMMUNICATION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To understand fundamentals associated with free‐space propagation and wireless channels. * To provide an overview of Wireless Communication networks area and its applications in communication engineering. * To study the basics of channel coding and multiple antenna.   **COURSE OUTCOMES:**  At the end of the course the student will be able   * To understand the basics of Wireless Communication Networks. * To motivate the students to pursue research in the area of wireless communication.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Overview of wireless communication;** Path loss and shadowing: Radio wave propagation, Transmit and receive signal models, Free space path loss, Ray tracing: two-ray model,ten-ray model-problems, Empirical path loss model: okumura model - hata model - piecewise linear model- indoor propagation models-problems, Simplified path-loss model, shadow fading, combined path loss and shadowing, Cell coverage area-problems. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Capacity of wireless channel:** Capacity of flat fading channel, Capacity of frequency selective fading channels – Problems.  **Diversity:** Receiver diversity: system model - selection combining - threshold combining - maximal ratio combining - equal gain combing, Transmitter diversity: channel known at transmitter - Alamouti scheme. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Channel coding: Linear block codes: Cyclic codes - Block Coding: Common linear block codes-Non binary block codes, Block coding with interleaving for fading channels, Convolution codes: Trellis diagram - maximum likelihood decoding - Viterbi Algorithm - Convolution Coding and Interleaving for Fading Channels, Concatenated codes, Turbo codes, Low density parity check codes. | | | | 7 |
| **IV** | **Multiple Antenna and Space time communication:** Narrow band MIMO Model, Parallel decomposition of MIMO, MIMO channel capacity: static and fading channel, MIMO diversity gain, Diversity/Multiplexing trade off, Space time modulation and coding: ML detection and pair wise error probability, rank and determinant criteria, Frequency selective MIMO channels. Problems not required.  **Equalization:** Equalizer noise enhancement, equalizer types, folded spectrum and ISI-free transmission, linear equalizer: Zero-forcing (ZF) equalizers, Minimum mean-square error (MMSE) equalizers.  **Multi carrier modulation:** Data transmission using multiple carriers, Multi carrier modulation with overlapping sub channels, Mitigation of subcarrier fading. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. 1. Andrea Goldsmith ,”Wireless Communications”, Stanford University 2. 2. ShuLin ,CostelloJr “Error control coding”, Pearson Education 3. 3. Andreas F Milosch, “Wireless Communication”,Wiley Interscience 4. 4. T.S. Rappaport, “Wireless Communication, principles & practice”, Prentice Hall of India 5. KamiloFeher, 'Wireless digital communication', Prentice Hall of India, 1995. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6122** | | **PRINCIPLES OF SECURE COMMUNICATION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To make the student understand the importance and goals of communication network andinformation security and introduce him to the different types of attacks. * To expose the student to the different approaches to handling security and the algorithms in use for maintaining data integrity and authenticity. * To enable the student to appreciate the practical aspects of security features design and their implementation in wired and wireless internetworking domains.   **COURSE OUTCOMES:**   * The student would be able to demonstrate an understanding of the ways in which communication network security may get compromised and the basic principles of security algorithm design. * The student would be able to implement and analyse the different algorithms and compare their performances. * The student would be in a position to apply his knowledge for designing or modifying existing algorithms and implementing them at least by simulation.   **SYLLABUS** | | | | | |  |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Rings and fields ‐ Homomorphism‐ Euclidean domains ‐ Principal Ideal Domains –Unique Factorization Domains - Field extensions‐ Splitting fields ‐ Divisibility‐Euler theorem ‐ Chinese Remainder Theorem ‐ Primality. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Basic encryption techniques‐Concept of cryptanalysis, Shannon’s theory, Perfect secrecy, Block ciphers, Cryptographic algorithms, Features of DES, Stream ciphers, Pseudo random sequence generators, linear complexity. Linear combination of LFSRs , Boolean functions. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Private key and Public key cryptosystems ‐ One way functions, RSA encryption ‐ Diffie Hellmann key exchange. Message authentication and hash functions ‐Digital signatures ‐ Secret sharing‐features of visual cryptography ‐ other applications of cryptography. | | | | 7 |
| **IV** | Elliptic curves ‐ Basic theory ‐ Weirstrass equation ‐ Group law ‐ Point at Infinity Elliptic curves over finite fields, Elliptic curve cryptography ‐ Diffie Hellmann key exchange over EC ‐ Elgamal encryption over EC ‐ ECDSA. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. 1. Douglas A. Stinson, “Cryptography, Theory and Practice”, 2nd edition, Chapman & Hall, CRC Press Company, Washington 2. 2. William Stallings, “ Cryptography and Network Security”, 3rd edition, Pearson Education 3. 3. Lawrence C. Washington, “ Elliptic Curves”, Chapman & Hall, CRC Press 4. 4. David S. Dummit, Richard M. Foote, “ Abstract Algebra”, John Wiley & Sons 5. 5. Evangelos Kranakis, “ Primality and Cryptography”, John Wiley & Sons 6. Rainer A. Ruppel, “ Analysis and Design of Stream Ciphers”, Springer Verlag | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6124** | | **MOBILE COMPUTING** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To make student to be familiar with the basics concept of Mobile Communication and mobile devices. * Focus will be on cellular mobile system units and different aspects of cellular communication. Course will cover the digital mobile communication system in details.   **COURSE OUTCOMES:**  After completion of the course, the students will be to:   * To present necessary concepts for Mobile Communication * Understanding different mobile devices and system * Understanding the Cellular System design * Study Co-channel and Non Co-channel Interference * Understanding channel assignment and hand off * Study Digital Cellular System   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction to Mobile Computing and Media access control : Mobile Computing(MC) : Introduction to MC, novel applications, limitations, and architecture. GSM : Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services. Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Mobile Network Layer and Transport Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP). Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues for Electrical and Electronic Systems. | | | | 7 |
| **IV** | Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Jochen Schiller,“Mobile Communications”,Addison-Wesley.,2nd edition, 2004. 2. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028. 3. Reza Behravanfar, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, ISBN: 0521817331, Cambridge University Press, October 2004. 4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren,“Fundamentals of Mobile and Pervasive Computing”, ISBN: 0071412379, McGraw-Hill Professional, 2005. 5. Hansmann, Merk, Nicklous, Stober, “Principles of Mobile Computing”, Springer, 2nd edition, 2003. 6. Martyn Mallick, “Mobile and Wireless Design Essentials”, Wiley DreamTech, 2003. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6126** | | **SPEECH TECHNOLOGY** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To understand the mathematical foundations needed for speech processing * To understand the basic concepts and algorithms of speech processing and synthesis * To familiarize the students with the various speech signal representation, coding and recognition techniques * To appreciate the use of speech processing in current technologies and to expose the students to real– world applications of speech processing.   **COURSE OUTCOMES:**  Upon completion of the course, the students will be able to:   * Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable and word. * Determine and apply Mel-frequency cepstral coefficients for processing all types of signals. * Justify the use of formant and concatenative approaches to speech synthesis * Identify the apt approach of speech synthesis depending on the language to be processed * Determine the various encoding techniques for representing speech.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Speech Production and Categorization of Speech Sounds**: Introduction to speech signal processing, overview of speech signal processing applications, human speech production mechanism, acoustic theory of speech production, nature of speech signal, spectrographic analysis of speech, categorization of speech sounds, coarticulation, prosody. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Speech Analysis and Synthesis:** Time and frequency domain analysis, Review of DSP techniques-z-transform, Discrete Fourier transform, short-time analysis of speech, linear prediction analysis, cepstral analysis, Contrasting linear prediction analysis and cepstral analysis, vector quantization(VQ) methods. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Speech Recognition:** Speech recognition, Bayes rule, segmental feature extraction, mel frequency cepstral coefficient(MFCC), dynamic time –warping(DTW), Gaussian mixture models (GMM), hidden Markov model(HMM), approaches for speech, speaker and language recognition. | | | | 7 |
| **IV** | Speech Coding, Speech Synthesis and Enhancement: Speech coding, quality measures, speech redundancies, time-domain waveform coding, Linear predictive coding, LPC residual coding, principles of speech synthesis, fundamentals of speech enhancement. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. 1. Douglas O’Shaugnessy, “Speech Communication, Human and Machine”, IEEE Press, 2000. 2. 2. L. Rabiner, B. H. Juang and B. Yegnanarayana, “Fundamentals of Speech Recognition”, Pearson India, 2009. 3. 3. T.F Quatieri, “Discrete-Time Speech Signal Processing- Principles and Practice”, Pearson, 2002. 4. 4. L.R. Rabiner and R. W. Schafer, "Theory and Applications of Digital Speech Processing", Pearson, 2010. 5. J R Deller, J H L Hansen, J G Proakis, “Discrete-time Processing of Speech Signals, IEEE, Wiley. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6128** | | **MULTI CARRIER COMMUNICATION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Familiarize the participants with Multicarrier Modulation Technique. * Discuss various variants of MCM and their respective applications. * Develop the needed channel estimation, equalization and synchronization functions, which are compatible with the multimode waveform processing solution. * Improve the efficiency through the exploitation of multiple antennas.   **COURSE OUTCOMES:**   * Explore applications of MCM techniques in wireless and wired communication systems.   **SYLLABUS** | | | | | | **SYSTEMS** |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Review of wireless channel characteristics – Multi carrier and OFDM system fundamentals – OFDM system model - Comparison with single carrier - Channel capacity and OFDM – FFT implementation – Power spectrum – Impairments of wireless channels to OFDM signals – Comparison with other multicarrier modulation scheme: MC CDMA. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Synchronization in OFDM – Timing and Frequency Offset in OFDM, Synchronization & system architecture, Timing and Frequency Offset estimation – Pilot and Non pilot based methods, Joint Time & Frequency Offset estimation. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Channel Estimation in OFDM systems – Differential and Coherent detection; Pilot symbol aided estimation - Block type and Comb type pilot arrangement; Decision directed channel estimation – MMSE estimation using time and frequency domain correlation; MIMO channel estimation- basic concepts; Concepts of Time and Frequency domain equalization. | | | | 6 |
| **IV** | Clipping in Multi carrier systems – Power amplifier non linearity – Error probability analysis – Performance in AWGN – PAPR properties of OFDM signals – PAPR reduction techniques with signal distortion; Techniques for distortion less PAPR reduction – Selective mapping and Optimization techniques. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Ahmad R.S. Bahai, B.R. Saltzberg, M. Ergen, “Multi carrier Digital Communications- Theory and Applications of OFDM”, Second Edition, Springer.  2. Y. Li. G. Stuber, “ OFDM for Wireless Communication”, Springer, 2006.  3. R. Prasad, “ OFDM for Wireless Communication”, Artech House, 2006. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6132** | | **RADAR COMMUNICATION SYSTEMS** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To understand the Radar Signal acquisition and sampling in multiple domains * To provide clear instruction in radar DSP basics * To equip the skills needed in both design and analysis of common radar algorithms   **COURSE OUTCOMES:**  After the completion of the course students should be able to:   * To understand the basics of synthetic aperture imaging and adaptive array processing * To illustrate how theoretical results are derived and applied in practice. * Student will be able to determine various design problem occurring in radar communication system.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Radar Block Diagrams and operations :** Radar frequencies , Pulse operations , Pulse repetitions, Frequency , Radar range equations , Minimum detectable signal , Receiver noise, Signal to noise ratio , Integration of radar pulses , Radar cross section , Propagation losses.  **Radar Systems :** Introduction to Pulse , CW, FM- CW , MTI , Non-coherent MTI , Doppler Radar ,Tracking radar , Synthetic Aperture Radar. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Detection of Radar Signals :** Matched filter receiver , Correlation Detection , Likelihood function , Detection Characteristics , Inverse probability , Optimum Design Criteria , Binary Integrators , Delay line Integrators. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Target Parameter Estimation :** Statistical Estimation of Parameters , Maximum Likelihood estimation , Theoretical accuracy of range and Doppler velocity measurements , Uncertainty relation , Angular Accuracy , Ambiguity function and radar transmitted Waveform design , Pulse compression Radar. | | | | 7 |
| **IV** | **Radar Applications :** Basic Concepts of Direction finders , Instrument landing systems , Ground controlled approach , Radar beacons , Bistatic Radar , Detection and tracking of extraterrestrial objects, Ionized media , Earth satellites and Space vehicles. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Skolnik M.M “Introduction to Radar systems” ,McGraw Hill 2nd Edn 1981. 2. F.E. Terman “Electronic and Radio Engineering”, McGraw Hill 4th Edn 1981. 3. D. Curtis Schleher “Introduction to Electronic Warfare”,Artech House Inc.,1986. 4. Wheeler .G.J “Radar Fundamentals “,Prentice Hall Inc.N.J 1967. 5. Lavanon Nadav “Radar Principles “,John Wiley & Sons , 1988 . | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6134** | | **OPTIMIZATION TECHNIQUES** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Understand the need and origin of the optimization methods. * To get a broad picture of the various applications of optimization methods used in engineering.   **COURSE OUTCOMES:**  After the completion of the course, students should   * Learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques. * Provide detailed theoretical and practical aspects of intelligent modeling, optimization and control of non-linear systems. * Prepare the students for developing intelligent systems through case studies, simulation examples and experimental results.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Unconstrained optimization:** Necessary and sufficient conditions for local minima, one dimensional search methods, gradient methods - steepest descent, Inverse Hessian, Newton’s method, conjugate direction method, conjugate gradient algorithm, quasi Newton methods. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Linear Programming:** Convex polyhedra, standard form of linear programming, Basic solutions, Simplex algorithm, Matrix form of the simplex algorithm, Duality, non simplex methods: Khachiyan method, Karmarkar’s method. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Nonlinear Constrained Optimization:** Equality constraints–Lagrange multipliers,inequality constraints – Kuhn-Tucker conditions, Convex optimization, Geometric programming, Projected gradient methods, Penalty methods. | | | | 7 |
| **IV** | **Introduction to Graph Theory and Combinatorial Optimization:** Routing-traveling salesman; Assignment – satisfiabilty, constraint saisfiabilty, graph coloring; Subsets- set covering, partitioning; Scheduling; Shortest path and Critical path algorithms. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Edwin K. P. Chong, Stanislaw H. ZAK, “An Introduction to Optimization “,2nd Ed, John Wiley & Sons 2. Stephen Boyd, LievenVandenberghe, “ Convex Optimization”, CUP, 2004. 3. R. Fletcher, “Practical methods of Optimization”, Wiley, 2000. 4. Jonathan L Grosss, Jay Yellen, Chapmamn and Hall, “Graph theory and its application”, 2e,CRC pub. 5. Alan Tucker, “Applied Combinatorics”, John wiley and Sons. 6. Dimitri P. Bertsekas, “Nonlinear programming”, Athena Scientific. 7. Belegundu, “Optimization Concepts and Applications in Engineering”, Prentice Hall,2000. 8. N Christofied, A Mingoss, P Toth, C Sandi, “Combinatorial Optimization”, John wiley& Sons. 9. Sivan Pemmaraju, S Skiens, “Computational Discrete Mathematics”, CUP, 2003 | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6136** | | **MIMO COMMUNICATION SYSTEMS** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To provide various aspects of MIMO communication systems for wireless broadband networks. * To introduce different MIMO channel models, channel capacity, bounds on channel capacity and influence of channel properties on the capacity. Diversity and spatial multiplexing techniques are also lectured for the basis of MIMO communication system. MIMO BLAST receivers are also covered in this course. * To introduce Orthogonal and quasi orthogonal design. A detailed study of space time block codes and trellis codes are also provided. * To introduce delay diversity and performance analysis of space time trellis code   **COURSE OUTCOMES:**  Upon completing this course student should be able to:   * Understand how to use MIMO system for wireless communication * Understand about MIMO channel models and channel capacity * Understand about the MIMO spatial multiplexing techniques * Capture the knowledge on MIMO BLAST receivers * Design orthogonal and quasi orthogonal space time block codes * Understand space time trellis codes   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Information Theoretic aspects of MIMO :** Review of SISO fading communication channels, MIMO channel models, Classical i.i.d. and extended channels, Frequency selective and correlated channel models, Capacity of MIMO channels, Ergodic and outage capacity, Capacity bounds and Influence of channel properties on the capacity. | | | | 8 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **MIMO Diversity and Spatial Multiplexing :** Sources and types of diversity, analysis under Rayleigh fading, Diversity and channel knowledge. Alamouti space time code, MIMO spatial multiplexing. Space time receivers. ML, ZF, MMSE and Sphere decoding, BLAST receivers and Diversity multiplexing trade-off. | | | | 8 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Space Time Block Codes :** Space time block codes on real and complex orthogonal designs, Code design criteria for quasi-static channels (Rank, determinant and Euclidean distance), Orthogonal designs, Generalized orthogonal designs, Quasi-orthogonal designs and Performance analysis**.** | | | | 6 |
| **IV** | **Space Time Trellis Codes :** Representation of STTC, shift register, generator matrix, state-transition diagram, trellis diagram, Code construction, Delay diversity as a special case of STTC and Performance analysis. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press 2005. 2. Hamid Jafarkhani, “Space-Time Coding: Theory and Practice”, Cambridge University Press 2005. 3. Paulraj, R. Nabar and D. Gore, “Introduction to Space-Time Wireless Communications”, Cambridge University Press 2003. 4. E.G. Larsson and P. Stoica, “Space-Time Block Coding for Wireless Communications”, Cambridge University Press 2008. 5. Ezio Biglieri, Robert Calderbank et al “MIMO Wireless Communications” Cambridge University Press 2007. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC6138** | | **SPREAD SPECTRUM COMMUNICATIONAND CDMA SYSTEMS** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To introduce the fundamentals of digital communication that is the foundation for many of the techniques employed in the generation of spread spectrum waveform. These include pseudo-random codes, modulation and demodulation techniques, synchronization, statistical distributions, direct sequence (DS) and frequency hopping (FH) spread spectrum, and capacity calculation for a CDMA system. * To give an overview of wireless architecture, spread spectrum communication, statistical distributions used in wireless communication, design of optimum receivers, calculation of theoretical capacity of a CDMA system, coding and decoding processes in CDMA, effects of interference in CDMA, and synchronization in CDMA wireless communication systems. * 3G wireless systems using CDMA technologies are also studied in this course.   **COURSE OUTCOMES:**  Upon completing this course student should be able to:   * Understand the architecture and elements of a spread-spectrum system and a CDMA system * Understand the characteristics of spread-spectrum signal waveforms * Apply their knowledge of communications technology to CDMA and wireless systems * Understand the methods for spread-spectrum and CDMA system performance analysis * Capture most recent development in CDMA and its role in 3G wireless systems   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Fundamentals of Spread Spectrum:** Introduction to spread spectrum communication, direct sequence spread spectrum, frequency-hop spread spectrum system. Spreading sequences- maximal-length sequences, gold codes, Walsh orthogonal codes- properties and generation of sequences. Synchronization and Tracking: delay lock and tau-dither loops, coarse synchronization principles of serial search and match filter techniques. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Performance Analysis of SS system:** Performance of spread spectrum system in jamming environments- Barrage noise jamming, partial band jamming, pulsed noise jamming and single tone jamming. Error probability of DS-CDMA system under AWGN and fading channels, RAKE receiver. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Capacity, Coverage and multiuser detection:** Basics of spread spectrum multiple access in cellular environments, reverse Link power control, multiple cell pilot tracking, soft and hard handoffs, cell coverage issues with hard and soft handoff, spread spectrum multiple access outage, outage with imperfect power control, Erlang capacity of forward and reverse links. Multi-user Detection -MF detector, decorrelating detector, MMSE detector. Interference Cancellation: successive, Parallel Interference Cancellation, performance analysis of multiuser detectors and interference cancellers**.** | | | | 8 |
| **IV** | **CDMA Systems**: General aspects of CDMA cellular systems, IS-95 standard, Downlink and uplink, Evolution to Third Generation systems, WCDMA and CDMA-2000 standards, Principles of Multicarrier communication, MCCDMA and MC-DS-CDMA. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Valery P. Ipatov, Spread Spectrum and CDMA Principles and Applications, Wiley, 2005. 2. R. L. Peterson, R. Ziemer and D. Borth, “Introduction to Spread Spectrum Communications,” Prentice Hall, 1995. 3. J. Viterbi, “CDMA - Principles of Spread Spectrum Communications,” Addison-Wesley, 1997. 4. S. Verdu, “ Multiuser Detection” , Cambridge University Press- 1998. 5. M. K. Simon, J. K. Omura, R. A. Scholts and B. K. Levitt, “ Spread Spectrum Communications Handbook”, McGraw- Hill, Newyork-1994. 6. Cooper and McGillem, “Modern Communications and Spread Spectrum” McGraw- Hill, 1985. 7. S. Glisic and B. Vucetic, “Spread Spectrum CDMA Systems for Wireless Communications,” Artech House, 1997. | | | | | |
|  | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC6177** | **SEMINAR I** | 1-1-0-2 | 2015 |
| **OBJECTIVES** :  This course is intended for :   * Increasing the breadth of knowledge * Enhancing the ability of self study * Improving presentation and communication skills * Augmenting the skill of Technical Report Writing.   **OUTCOME:**  Students will be able to   * Identify important concepts from the readings and provided depth in coverage of the topic. * Develop effective group communication and presentation skills. * Develop self-management & reflection skills. | | | |
| **DESCRIPTION:** | | | |
| Each student shall present a seminar on any topic of interest related to the core/elective courses offered in the 1st semester of the M. Tech. Programme. He / She shall select the topic based on the references from international journals of repute, preferably IEEE journals. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted | | | |
|  | | | |
|  | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC6188** | **MINI PROJECT** | 0-0-4-2 | 2015 |
| COURSE OBJECTIVES:   * In Mini Project the student shall undergo Mini Project of two months duration. * The mini project is designed to develop practical ability and knowledge about practical tools/techniques in order to solve the actual problems related to the industry, academic institutions or similar area.   **COURSE OUTCOMES:**  Upon completion of mini project, Students will:   * acquire System integration skills, Documentation skills, Project management skills, Problem solving skills * be able to Identify problems and solutions and also solve real-life problems * develop Professionalism * develop oral as well as written presentation skills | | | |
| **DESCRIPTION:** Students can take up any application level/system level project pertaining to a relevant domain. Projects can be chosen either from the list provided by the faculty or in the field of interest of the student. For external projects, students should obtain prior permission after submitting the details to the guide and synopsis of the work. The project guide should have a minimum qualification of ME/M.Tech in relevant field of work. At the end of each phase, presentation and demonstration of the project should be conducted, which will be evaluated by a panel of examiners. A detailed project report duly approved by the guide in the prescribed format should be submitted by the student for final evaluation. Publishing the work in Conference Proceedings/ Journals with National/ International status with the consent of the guide will carry an additional weightage in the review process. | | | |
|  | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC6192** | **COMMUNICATION SYSTEMS AND NETWORKING LAB** | 0-0-2-1 | 2015 |
| COURSE OBJECTIVES:  This course is designed   * + To impart practical knowledge about fading channels, OFDMand different source coding and channel coding techniques.   + Simulate and evaluate Ethernet and Token Ring.   + To develop knowledge on Packet Switched Networks, Simple Sensor Networks and Mobile Adhoc Networks.   + To understand the performance of TCP.   + To Model Physical layer and MAC layer of wireless networks.   **COURSE OUTCOMES:**  Upon completion of this lab, Students will be:   * Able to understand the characteristics of different multiple access techniques in mobile/wireless communication. * Able to understand the need of coding, Channel models, Diversity, Equalization and Channel estimation techniques. * Able to apply analytical and empirical models in the design of wireless links. * Able to understand the Ad Hoc networks and new trends in Mobile/wireless communication. * Able to understand the radio propagation over wireless channel and different limitations. * Able to apply analytical and empirical models in the design of wireless link | | | |
| LIST OF EXERCISES / EXPERIMENTS (18 hrs) | | | |
| 1. Modeling and Simulation of Radio Channels - Multipath Fading Channels- Jake’s Model 2. Frequency non-selective and frequency selective fading channels realization 3. OFDM system simulation, BER performance in fading channels 4. Channel estimation in OFDM 5. Synchronization in OFDM 6. Source Coding: Hamming code, Huffmann coding 7. Arithmetic Coding 8. Channel Coding- Linear Block Code 9. Convolutional codes , Viterbi decoding 10. Cyclic codes 11. Ethernet and Token Ring simulation and Evaluation 12. Scheduling and Queuing Disciplines in Packet Switched Networks: FIFO, Fair Queuing, RED 13. TCP Performance analysis with and without RED 14. Modelling of Wireless Networks : Physical layer and MAC layer 15. Simple Sensor Networks Simulation and Evaluation 16. Mobile Adhoc Network Simulation and Evaluation   Tools: Numerical Computing Environments – GNU Octave or MATLAB, Simulink, LabVIEW or any other equivalent tool and specialized tools like OPNET/NS-2 etc.  Suitable Hardware Tools like USRP (Universal Software Radio Peripheral) to supplement the simulation tools.  Minimum 10 experiments from the above list should be completed.  \*\*\* Topics could be added in concurrence with the syllabus of elective subjects offered | | | |
| **INTERNAL TEST** | | | |
| **REFERENCES:**   1. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, “ Principles of Communication System Simulation with Wireless Applications,” Pearson, 2004. 2. E. Aboelela, “Network Simulation Experiments Manual,” The Morgan Kaufmann Series in Networking, 2007. 3. Larry. L. Peterson and Bruce s. Davice, “Computer Networks a System Approach. Network Simulation experiments Manual. Elsevier Edition 4”. 4. J.G. Proakis, and M. Salehi, “Contemporary Communication Systems using MATLAB, Bookware Companion Series, 2006. | | | |
|  | | | |

**SEMESTER III**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7141** | | **SOFT COMPUTING TECHNIQUES** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Introduce students to soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems. * Explain the students about fuzzy sets and its operations. * Introduce students to fuzzy systems, fuzzy logic and its applications, genetic algorithm fundamentals and its operators and procedure, Artificial Neural Networks and various categories of ANN, Different optimization algorithms different types hybrid systems   **COURSE OUTCOMES:**   * By the end of the course a student is expected to become able to: * Recognize the feasibility of applying a soft computing methodology for a particular problem * Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems * Apply genetic algorithms to combinatorial optimization problems. * Apply neural networks to pattern classification and regression problems and compare solutions by various soft computing approaches for a given problem.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Neural Networks:** Supervised Learning Neural Networks – Perceptrons-Multilayerperceptrons-Backpropagation- Radial Basis Function Networks – Unsupervised Learning NeuralNetworks – Competitive Learning Networks – Kohonen Self- Organizing Networks –Learning Vector Quantization – Hebbian Learning. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Fuzzy Set Theory** : Fuzzy Sets – Basic Definition and Terminology – Set- theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If- Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models–Input Space Partitioning and Fuzzy Modeling.. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Optimization :** Derivative-based Optimization – Descent Methods – The Method of Steepest Descent –Classical Newton’s Method – Step Size Determination –Derivative-free Optimization –Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search. | | | | 7 |
| **IV** | **Neuro Fuzzy Modeling :** Adaptive Neuro-Fuzzy Inference Systems – Architecture– Hybrid Learning Algorithm –Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Satheeshkumar “Neural Networks: A class room approach”, Tata McGraw Hill, Seocnd Edition, 2012. 2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw- Hill, 1997. 3. S. N. Sivandan and S. N. Deepa "Priciples of soft computing", Wiley- India, second edition, 2011. 4. S. Rajasekaran, G. A. VijayalakshmiPai , “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications” .Prrentice Hall of India,2010 5. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”,PHI, 2004,Pearson Education 2004 6. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989 | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7143** | | **ADAPTIVE FILTERS AND SYSTEMS** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To introduce some practical aspects of signal processing, and in particular adaptive systems. Current applications for adaptive systems are in the fields of communications, radar, sonar, seismology, navigation systems and biomedical engineering. * To present the basic principles of adaptation; will cover various adaptive signal processing algorithms (e.g., the LMS algorithm) and many applications, such as adaptive noise cancellation, interference cancelling, system identification, etc.   **COURSE OUTCOMES:**   * After completing the course the student will get the ability to analyze and compare the performance of different adaptive signal processing algorithms. * The course develops an attitude to propose solutions with comparisons for problems related to the principles of adaptation.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction to adaptive filters, Review and background, Stochastic processes, Linear Algebra, Estimation. Optimum Filtering, The normal equations, Applications and Design Examples | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Minimum mean square error estimation and the orthogonality principle, Linear prediction, Gradient-based adaptive filters, Steepest descent, Newton's Method, Applications and Design Examples | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | The LMS algorithm, Gradient estimation, Variations on the LMS algorithm, Applications and Design Examples. | | | | 7 |
| **IV** | Least-Squares Problem, Weighted Least-Squares, Regularized Least-Squares Recursive Least Squares (RLS) algorithms, Exponentially weighted RLS, Applications and Design Examples. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. A. H. Sayed, Adaptive Filters, John Wiley & Sons, NJ, 2008. 2. Simon Haykin, Adaptive Filter Theory, Pearson Education India, 2005 3. http://iracema.icsl.ucla.edu/ | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7145** | | **FPGA BASED SYSTEM DESIGN** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To introduce fundamentals and circuit architectures of field programmable gate arrays (FPGAs), design tools supporting FPGA-based system designs, and their applications in reconfigurable computing. * Students will gain hands-on experience of designing system with FPGAs, and learn the basics of design tools targeted for FPGA based designs. * The applications of FPGAs in various custom computing environments will also be examined.   **COURSE OUTCOMES:**  Upon completion of the course students will gain knowledge and understanding of   * Different technologies to implement digital computing systems. * Various FPGA architectures. * Automated design flows supporting designs with FPGAs. * Fundamentals of the FPGA design tools. * The reconfigurable computing systems and the roles of FPGAs in those systems.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Evolution of programmable devices: Introduction to AND-OR structured Programmable Logic Devices PROM, PLA, PAL and MPGAs; Combinational and sequential circuit realization using PROM based Programmable Logic Element (PLE); Architecture of FPAD, FPLA, FPLS and FPID devices. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | FPGA Technology: FPGA resources - Logic Blocks and Interconnection Resources; Economics and applications of FPGAs; Implementation Process for FPGAs Programming Technologies - Static RAM Programming, Anti Fuse Programming, EPROM and EEPROM Programming Technology; Commercially available FPGAs - Xilinx FPGAs, Altera FPGAs; FPGA Design Flow Example - Initial Design Entry, Translation to XNF Format, Partitioning, Place and Route, Performance Calculation and Design Verification. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Technology Mapping for FPGAs: Logic Synthesis - Logic Optimization and Technology Mapping; Lookup Table Technology Mapping - Chortle-crf Technology Mapper, Chortle-d Technology Mapper, Lookup Table Technology Mapping in mis-pga, Lookup Table Technology Mapping in Asyl and Hydra Technology Mapper; Multiplexer Technology Mapping - Multiplexer Technology Mapping in mis-pga. | | | | 7 |
| **IV** | Routing for FPGAs: Routing Terminology; Strategy for routing in FPGAs; Routing for Row- Logic Block Architecture: Logic Block Functionality versus Area-Efficiency - Logic Block Selection, Experimental Procedure, Logic Block Area and Routing Model and Results. Based FPGAs - Segmented channel routing, 1-channel routing algorithm, K – channel routing algorithm and results.. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. FPGA-Based System Design Wayne Wolf, Verlag: Prentice Hall 2. Modern VLSI Design: System-on-Chip Design (3rd Edition) Wayne Wolf, Verlag | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7147** | | **NETWORK ADMINISTRATION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To understand the need for interoperable network management * To learn to the concepts and architecture behind standards based network management * To understand the concepts and terminology associated with SNMP and TMN * To understand network management as a typical distributed application * To study the current trends in network management technologies   **COURSE OUTCOMES:**  Upon completion of this course, the students will be able to   * Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets. * Apply network management standards to manage practical networks and formulate possible approaches for managing OSI network model. * Use SNMP for managing the network and RMON for monitoring the behaviour of the network. * Explore the possibilities of improving the speed of the network and managing them. * Identify the various components of network and formulate the scheme for managing them   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Advanced Socket& I/O functions:** IPV4 and IPV6 interoperability intend super server. Advanced I/O functions, unix domain protocols, Non blocking I/O, ioctl operations, Routing Sockets. Data link socket address structure, Reading and writing, sysctd operations, get-ifi-info function, Interface name & index functions. Key management Sockets: Reading and writing, Dumping the security association database(SADB), Creating a static security association(SA), Dynamically maintaining SAs. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Broadcasting & Multicasting:** Broadcast addresses, Unicast verses Broadcast, dg-cli function using broadcasting, Race function, Multicasting: Multicasting addresses, Multicasting verses Broadcasting on a LAN, Multicastingona WAN, Source-specified multicast, Multicast socket options, mcast\_join and related functions, dg\_cli function using multicasting, Receiving IP multicast infrastructure session announcements, sending and receiving, Simple network time protocol. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Advanced UDP sockets**: Receiving flags, destination IP addresses, interface index, Datagram truncation, UDP verses TCP,. Adding reliability to UDP application , Binding interface addresses, on current UDP services, IPV6 packet information, IPV6 path MTU control. | | | | 7 |
| **IV** | **Advanced SCTP sockets**: Auto closing, Partial delievery, Notification, Unordered data, Binding a subset of addresses, Determining peer and local addresses, Association of ID and IP addresses,  Peeling off and association, controlling timing SCTP verses TCP. Out\_of\_Band data : TCP Out\_of\_Band data, socket: mark function.  **Raw sockets:** Raw sockets creation, Raw socket output, Raw socket input, ping program, trace route program, ICMP message daemon. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Fenner, Rudoff, “UNIX Network Programming (3rd Edition) Stevens”, PearsonEducation.  2. Write, Stevens, “TCP/IP illustrated (V2)” Pearson education.  3. Comer, Stevens , “Internetworking with TCP/IP (V2)”, Pearson education. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7151** | | **SIGNAL COMPRESSION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To introduce to the students the fundamentals of data compression and data security. Despite the exponential growth in memory and transmission capacity, many high-bandwidth applications, such as digital storage and transmission of video, would not be possible without compression. * The goal of this subject is to give post-graduate students a conceptual understanding, and hands-on experience, of the state-of-the-art compression algorithms and approaches. These include both lossless and lossy compression techniques with an emphasis on widely deployed, standardized coding schemes. Due to time constraints, priority will be given to the algorithmic/implementation side of the problems, with formal arguments taking a back seat.   **COURSE OUTCOMES:**   * By the end of the course, students should expect to have a sound understanding behind the principles and practice of state-of-the-art data compression techniques. * Students will have implemented from scratch a non-trivial version of a mainstream data compression technique.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Lossless Compression:** self information, average information, models, uniquely decodable codes, prefix codes, Kraft-McMillan inequality, Huffman coding, extended Huffman coding, non binary Huffman coding; arithmetic coding – coding a sequence, generating a binary code; dictionary techniques –LZ77, LZ78, LZW; context-based compression – ppm, Burrows- Wheeler transform. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Lossy Coding:** distortion criteria, conditional entropy, average mutual information, differential entropy, rate distortion theory; rate distortion theorem, converse of the rate distortion theorem, models.  **Scalar Quantization:** uniform, adaptive, nonuniform, entropy-coded quantization | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Vector Quantization:** advantages over scalar quantization, LBG algorithm, tree structured and structured vector quantizers, trellis-coded quantization  **Differential Encoding:** basic algorithm, prediction in DPCM, adaptive DPCM, delta modulation, speech coding – G.726. | | | | 7 |
| **IV** | **Transform Coding:** Introduction, Karhunen-Loeve transform, discrete cosine transform, discrete Walsh Hadamard transform, quantization and coding of transform coefficients, JPEG, MDCT  **Subband coding:** filters, basic subband coding algorithm.  **Wavelet Based Compression**: multiresolution analysis, image compression, EZW coder, SPIHT | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Khalid Sayood, “Introduction to Data Compression”, 3/e, Elsevier. 2. David Salomon, “Data Compression: The Complete Reference”, Springer. 3. Thomas M. Cover, Joy A. Thomas, “Elements of Information Theory," Wiley India 4. Ali N. Akansu, Richard A. Haddad, “Multiresolution Signal Decomposition: Transforms, Subbands and Wavelets”, Academic Press, 1992. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7153** | | **ESTIMATION AND DETECTION THEORY** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To provide basic estimation and detection background for engineering applications. After taking this course, students should have enough understanding of the main concepts and algorithms of detection and estimation theory for practical applications as well as for their research.   **COURSE OUTCOMES:**   * By the end of the course, the students get complete idea of different estimation approaches and gain the ability to apply estimation methods to real engineering problems.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Hypothesis Testing:** Criteria in Hypothesis Testing, neyman pearson criterion, bayes criterion and minimum probability of error criterion, likelihood ratio test, application examples- signal constellations and the matched filter, binary symmetric channel. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Detection:**Detection with unknown signal parameters (UMP tests, GLRT, Bayes factor), MAP rule, multiple decision problem, detection of deterministic and random signals in noise. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Parameter Estimation:** Unbiased estimates- minimum variance unbiased estimates (MVUE), methods of finding MVUE, cramer-rao bound sufficient statistics, rao-blackwell theorem, best linear unbiased estimators (BLUE). | | | | 7 |
| **IV** | **Method of Moments:** Method of moments, Maximum likelihood estimators, Bayes estimators (MAP, MSE). Linear Estimators:- MA, AR, ARMA processes and their properties, MMSE linear estimate. Weiner Filter. Kalman Filter. Lattice filter structure, Levinson Durbin and innovation algorithms. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. H. L. Van Trees, “Detection, Estimation, and Modulation Theory”, Vol. I, John Wiley & Sons, 1968  2. Steven Kay, “Fundamentals of Statistical Signal Processing” Vol I: Estimation Theory. Prentice Hall.  3. Steven Kay, “Fundamentals of Statistical Signal Processing” Vol II: Detection Theory. Prentice Hall. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7155** | | **REMOTE SENSING** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * The objective of this course is to familiarize about the principles of remote sensing and the data acquisition and analysis of satellite data.   **COURSE OUTCOMES:**   * By the end of the course, the students get complete idea of Data acquisition, Scattering system, Thermal and hyper spectral remote sensing.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Principles of remote sensing**: Introduction of Remote Sensing - Electro Magnetic Spectrum, Physics of Remote Sensing- Effects of Atmosphere- Scattering – Different types –Absorption-Atmospheric window- Energy interaction with surface features – Spectral reflectance of vegetation, soil ,and water –atmospheric influence on spectral response patterns- multi concept in Remote sensing. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Data acquisition:** Types of Platforms – different types of aircrafts-Manned and Unmanned spacecrafts – sun synchronous and geo synchronous satellites – Types and characteristics of different platforms – LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc - Photographic products, B/W, colour, colour IR film and their characteristics – resolving power of lens and film - Opto mechanical electro optical sensors – across track and along track scanners – multi spectral scanners and thermal scanners – geometric characteristics of scanner imagery - calibration of thermal scanners. | | | | 8 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Scattering system:** Microwave scatterometry – types of RADAR – SLAR – resolution - range and azimuth – real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect - different types of Remote Sensing platforms –airborne and space borne sensors – ERS, JERS, RADARSAT, RISAT - Scatterometer, Altimeter- LiDAR remote sensing, principles, applications. | | | | 7 |
| **IV** | **Thermal and hyper spectral remote sensing:** Sensors characteristics - principle of spectroscopy - imaging spectroscopy - field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, VI edition of John Wiley & Sons-2000.  2. John R. Jensen , Introductory Digital Image Processing: A Remote Sensing Perspective , 2nd Edition, 1995.  3. John A.Richards, Springer –Verlag, Remate Sensing Digital Image Analysis 1999.  4. Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.  5. Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.  6. Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman & Co, 1978. | | | | | |
|  | | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC7157** | | **SYSTEM DESIGN USING ARM** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * The course curriculum is designed to provide strong foundation in Microcontrollers, ARM Processor architectures, Open source electronic hardwares and application oriented programming for an embedded product.   **COURSE OUTCOMES:**  Students are able to   * Describe the programmer’s model of ARM processor and create and test assembly level programming. * Analyze various types of coprocessors and design suitable co-processor interface to ARM processor. * Analyze floating point processor architecture and its architectural support for higher level language. * Become aware of the Thumb mode of operation of ARM. * Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **General system design**: Embedded Computing: Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Formalisms for System Design, Design Examples.  **ARM Introduction:** Introduction to processor design-architecture and organization, Abstraction in hardware design, Instruction set design, Processor design tradeoffs, RISC. Overview of ARM architecture – Architecture inheritance, Programmer`s model, Development tools. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **ARM Instruction Set:** ARM assembly language programming, ARM organization and implementation, ARM instruction set (exceptions, conditional execution, branch in instructions, multiply instructions, coprocessor instructions). | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Architectural support for high level languages-**Data types, Floating point data types, Conditional statements, Loops, Use of memory, Run-time environment  **Thumb instruction set-**Thumb bit, Thumb programmer`s model, Thumb branch instructions, Thumb software interrupt instructions**.**  **Architectural support for system development-** ARM memory interface, AMBA, ARM reference peripheral specifications, h/w system prototyping tools, ARM modulator, JTAG, ARM debug architecture, Embedded trace, signal processing support, ARM processor cores | | | | 8 |
| **IV** | **Memory hierarchy-**Memory size and speed, On-chip memory, Caches, Memory management. Architectural support for OS - Introduction, ARM system control coprocessor, ARM MMU architecture, Context switching.  **Embedded ARM applications**-ARM7500 and ARM 7500FE & The SA-**1100**  **AMULET asynchronous ARM processors** - Self-timed design & AMULET1. | | | | 5 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. ARM System-on-chip architecture, Steve Furber, Pearson Education  2. Computers as Components-principles of Embedded computer system design, Wayne Wolf, Elseveir  3. ARM System Developer`s Guide ,Andrew N Sloss, Dominic Symes, Chris Wright, Elseveir  4. An Embedded Software Primer, David E. Simon, Pearson Education. | | | | | |
|  | | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC7167** | **SEMINAR II** | 0-0-2-2 | 2015 |
| COURSE OBJECTIVES:   * To improve the professional competency and research aptitude. * To motive and energize talent. * To improve presentation skills.   **COURSE OUTCOMES:**   * After successful completion of the seminar presentation, the students will be able to analyse and present technological and research topics more effectively. | | | |
| DESCRIPTION: | | | |
| Each student shall present a seminar on any topic of interest related to the core/elective courses offered in the 1st semester of the M. Tech. Programme. He / She shall select the topic based on the references from international journals of repute, preferably IEEE journals. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted. | | | |
|  | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC7187** | **PROJECT (PHASE 1)** | 0-0-12-6 | 2015 |
| In Project Phase-I, the students are expected to select an emerging research area in the field of specialization. After conducting a detailed literature survey, they should compare and analyze research work done and review recent developments in the area and prepare an initial design of the work to be carried out as Master’s Thesis. It is mandatory that the students should refer National and International Journals and conference proceedings while selecting a topic for their thesis. He/She should select a recent topic from a reputed International Journal, preferably IEEE/ACM. Emphasis should be given for introduction to the topic, literature survey, and scope of the proposed work along with some preliminary work carried out on the thesis topic.  Students should submit a copy of Phase-I thesis report covering the content discussed above and highlighting the features of work to be carried out in Phase-II of the thesis. The candidate should present the current status of the thesis work and the assessment will be made on the basis of the work and the presentation, by a panel of internal examiners in which one will be the internal guide. The examiners should give their suggestions in writing to the students so that it should be incorporated in the Phase–II of the thesis.  COURSE OBJECTIVES:   * To improve professional competency, research aptitude and team work skills. * To identify real world issues and develop innovative solutions. * To motive and energize talent. * To develop an aptitude to deliver commitments and manage time and stress pressures.   GUIDELINES:   1. Projects can be done individually, or in teams of two students. For a two-person group, group members are responsible for dividing up the work equally and making sure that each member contributes. 2. At least 50% should be continuing Projects so that it will evolve to an industry acceptance level. 3. Students in the first and second semester also should be associated with the Project work so as to improve continuity. 4. The groups are encouraged to come up with original ideas and novel real world applications for the projects. 5. The projects should involve well-designed experiments and thorough analysis of the experimental results. 6. It is highly desirable to produce a Research Paper and Patents based on the Project work. | | | |
|  | | | |

**SEMESTER IV**

|  |  |  |  |
| --- | --- | --- | --- |
| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC7188** | **PROJECT (PHASE 2)** | 0-0-21-12 | 2015 |
| Phase 2 of the Project is the continuation of the work done in Project -Phase 1 which includes   1. Making necessary changes in the specifications and experimental methods based on the suggestions by the expert committee. 2. Detailed design. 3. Simulation and experimental works to realize the specifications of the project. 4. Result Analysis and Conclusion. 5. Preparation of the Project Report.   The evaluation of M Tech Thesis will be carried out by a panel of examiners including at least one external examiner appointed by university and internal examiner. The work carried out should lead to a publication in a National / International Conference or Journal. The papers received acceptance before the M.Tech evaluation will carry specific weightage.  COURSE OBJECTIVES:   * To improve the professional competency, research aptitude and team work skills. * To identify real world issues and develop innovative solutions. * To motive and energize talent. * To develop an aptitude to deliver commitments and manage time and stress pressures.   **COURSE OUTCOME:**  Project work enhances students' knowledge and enables them to acquire skills like collaboration, communication and independent learning, prepares them for lifelong learning and the challenges ahead. In summary, project work teaches students about:   * thinking * research * problem-solving * public presentation | | | |
|  | | | |