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| **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**  **COMMUNICATION ENGINEERING**  **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: COMMUNICATION ENGINEERING**

**SEMESTER – I**

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| **Exam Slot** | **Course No:** | **Name** | **L- T - P** | **Internal**  **Marks** | **End Semester Exam** | | **Credits** |
| Marks | Duration (hrs) |
| A | 05EC 6201 | Probability Theory & Stochastic Process | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05EC 6203 | Wireless Communication | 3-1-0 | 40 | 60 | 3 | 4 |
| C | 05EC 6205 | Advanced Digital Communication | 3-1-0 | 40 | 60 | 3 | 4 |
| D | 05EC 6207 | Wireless Networks | 2-1-0 | 40 | 60 | 3 | 3 |
| E | 05EC 621x | Elective 1 | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05EC6277 | Research methodology | 1-1-0 | 100 | 0 | 3 | 2 |
|  | 05EC6291 | Lab - Communication System Design Lab&Microwave Engg& Fibre optics lab | 0-0-2 | 100 | 0 | 0 | 1 |

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| **Elective – I** | |
| **Course No** | **Subjects** |
| 05EC 6211 | Coding Theory |
| 05EC 6213 | Multimedia Communication |
| 05EC 6215 | Advanced Optical communication System |

**SEMESTER – II**

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| **Exam**  **Slot** | **Course No:** | **Subjects** | **L-T-P** | **Intern**  **al**  **Marks** | **End Semester**  **Exam** | | **Credits** |
| **Marks** | **Duration**  **(hrs)** |
| A | 05EC 6202 | Advanced Radiation systems | 3-1-0 | 40 | 60 | 3 | 4 |
| B | 05EC 6204 | Multi Carrier Communication | 2-1-0 | 40 | 60 | 3 | 3 |
| C | 05EC 6206 | AdaptiveSignalProcessing | 2-1-0 | 40 | 60 | 3 | 3 |
| D | 05EC 622x | Elective2 | 2-1-0 | 40 | 60 | 3 | 3 |
| E | 05EC 623x | Elective3 | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05EC 6266 | Seminar I | 0-0-2 | 100 | 0 | 0 | 2 |
|  | 05EC 6288 | Mini Project | 0-0-4 | 100 | 0 | 0 | 2 |
|  | 05EC 6292 | Lab - Network Simulation | 0-0-2 | 100 | 0 | 0 | 1 |

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| **Elective – II** | |
| **Course No** | **Subjects** |
| 05EC 6222 | Wimax -Broadband wireless Technology |
| 05EC 6224 | Optical Networks |
| 05EC 6226 | Principles of Secure Communication |

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| **Elective – III** | |
| **Course No** | **Subjects** |
| 05EC 6232 | RF MEMS |
| 05EC 6234 | CDMA technology |
| 05EC 6236 | Wireless Ad hoc & Sensor Networks |

**SEMESTER – III**

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| **Exam**  **Slot** | **Course**  **No** | **Subjects** | **L-T-P** | **Internal**  **Marks** | **End Semester Exam** | | **Credits** |
| **Marks** | **Duration(hrs)** |
| A | 05EC 724x | ElectiveIV | 2-1-0 | 40 | 60 | 3 | 3 |
| B | 05EC 725x | ElectiveV | 2-1-0 | 40 | 60 | 3 | 3 |
|  | 05EC 7267 | Seminar II | 0-0-2 | 100 | 0 | 0 | 2 |
|  | 05EC 7287 | Project (Phase 1) | 0-0-8 | 50 | 0 | 0 | 6 |

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| **Elective – IV** | |
| **Course No** | **Subjects** |
| 05EC 7241 | Cognitive Radio |
| 05EC 7243 | Cellular Mobile Communication systems |
| 05EC 7245 | VLSI for Wireless Communication |

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| **Elective – V** | |
| **Course No** | **Subjects** |
| 05EC 7251 | Smart Antennas |
| 05EC 7253 | Mobile Satellite Communication |
| 05EC 7255 | Network Routing Algorithm |

**SEMESTER – IV**

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| **Exam**  **Slot** | **Course**  **No** | **Subjects** | **L-T-P** | **Internal**  **Marks** | **End Semester Exam** | | | **Credits** |
| **Marks** | | **Duration(hrs)** |
|  | 05EC7288 | Project(Phase 2) | 0-0-21 | 70 | 30 | - | | 12 |

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Total:68

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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6201** | | **PROBABILITY THEORY & STOCHASTIC PROCESS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * + Basic concepts of probability theory , random variables ,&vector spaces   + Analysis of Conditional probability , distribution and convergence concepts   + Analysis of stochastic process and application to the signal processing in the communication system.   **COURSE OUTCOMES:**   * + The students will able to apply the concepts of probability and stochastic process for analyzing the performance of communication systems.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36 hrs) | | | | HRS |
| **I** | Probability – Discrete & Continuous Random variables- Distributions and densities.- . Statistical independence - Expectations, moments and characteristic functions - Binomial- Poisson - Chi square -Rayleigh- Rician - Nakagami and Multi variate – Normal –lognormal distributions - Infinite sequences of random variables- Convergence concepts- Laws of large numbers. | | | | 10 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Vector Spaces- Spanning set and basis-null space and range- rank nullity theorem- Inner product- norm- Orthogonality -Gram – Schmidt orthonormalization - Orthonormal basis- Projection Theorem. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Stochastic processes. Separability and measurability- Continuity concepts- Gaussian processes and Wiener processes- Second order processes. Covariance functions - properties. Linear operations and second order calculus. Orthogonal expansions- Stationary in the strict and wide sense- Ergodic process | | | | 9 |
| **IV** | Spectrum Estimation - Non-Parametric Methods-Correlation Method – Co-Variance Estimator -Performance Analysis of Estimators -Model based Approach – AR-MA, ARMA Signal Modeling. | | | | 8 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Gilbert Strang ” Introduction to Linear Algebra “ 4th edition  2. A.Papoulis, S.U.Pillai, “Proabability, Random variables and Stochastic processes” 4th edition Tata-Mc Hill (4/e), 2001  3. R.B.Ash & C.Doleans-Dade, Probability and Measure Theory (2/e), Elsevier, 2005  4. E.Wong & B.Hajek, Stochastic Processes in Engineering systems, Springer, 1985  5. R.B.Ash & W.A.Gardner, Topics in stochastic processes, Academic Press, 1975.  6. Stakgold, I., Green’s Functions and Boundary value Problems (e), Wiley, 1998  7. Sopocles J. Orfanidis, Optimum Signal Processing, McGraw Hill, 1990  8. John G Proakis, Mausad Salehi, “Digital Communications” McGraw Hill, 5th edition.2007  9. Peebles, Probability, Random Variables & Random Signal Principles, Tata McGraw-Hill Education, 2002 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6203** | | **WIRELESS COMMUNICATION** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To impart the Design Fundamentals & access schemes in wireless communications   **COURSE OUTCOMES:**   * Understand channel models & new concepts in multiple access used in wireless communication systems   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36hrs) | | | | HRS |
| **I** | **System Design Fundamentals:** Cellular concept-channel reuse- handoff strategies-dynamic resource allocation-interference and system capacity-improving capacity and coverage of cellular systems-Second and third generation network standards: GSM standardization-architecture and function -Partitioning-GSM radio aspects-security aspects-protocol model-call flow sequences-evolution to 2.5G mobile radio networks. IS-95 service and radio aspects, key features of IS-95 CDMA systems- ECWDMA-UMTS physical layer-UMTS network architecture-CDMA 2000 physical layer | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Small scale multipath propagation- Impulse response model of a multipath channel –small scale multipath measurements-parameters of mobile multipath channels - –types of small scale fading. Capacity of Flat Fading Channel- Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – ThresholdCombining – Maximal-Ratio Combining – Equal - Gain Combining – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme- RAKE receivers. | | | | 9 |
| **IV** | Spread spectrum multiples access- space division multiple access- packet radio. MIMO and multicarrier modulation: Narrowband MIMO model-parallel decomposition of MIMO channel-MIMO channel capacity-MIMO diversity gain –data transmission using multiple carriers- multicarrier modulation with overlapping sub channels -mitigation of subcarrier fading- OFDM. | | | | 9 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Andrea Goldsmith, “Wireless Communications,” Cambridge University Press, 2005  2. T.S. Rappaport, “Wireless Communications,” Pearson Education, 2003  3 .Raj Pandya, “Mobile and Personal Communication Systems and Services,” Prentice Hall of India,  2002  4 William C.Y. Lee, “Wireless and Cellular Telecommunications,” Third edition, Mc. Graw  Hill, 2006. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6205** | | **ADVANCED DIGITAL COMMUNICATION** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To learn various digital modulations, channel coding, equalization and   synchronization techniques of the digital communication systems.  **COURSE OUTCOMES:**   * Advanced concepts of digital communication techniques   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36hrs) | | | | HRS |
| **I** | Review of Random variables, probability distribution and density functions, Binomial, Gaussian, Chi square, Rayleigh, Rician, Nakagami and Multi variate Gaussian distributions – PDFs and moments, Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK--BER Performance Analysis. Carrier Synchronization- Bit synchronization. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Waveform and vector channel models: optimal detection for a general vector channel, MAP and ML,receiver, decision regions, error probability, 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. | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Carrier Recovery and Symbol Synchronization in Signal Demodulation- Signal parameter estimation, Carrier Phase Estimation-, Maximum Likelihood phase estimation, Phase locked loop, Effect of additive noise on the phase estimate; Symbol Timing Estimation- Maximum Likelihood timing estimation- Receiver structure with phase and timing recovery; Joint Estimation of Carrier phase and Symbol Timing | | | | 9 |
| **IV** | Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes- Clipping, Filtering, Coding and Scrambling. | | | | 9 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995. 2. J.G. Proakis, M. Salehi, “Digital Communication”, MGH 5th edition, 2008. 3. J.G. Proakis, M. Salehi, “Fundamentals of Communication systems”, Pearson, 2005. 4. Sheldon.M.Ross, “Introduction to Probability Models”, Elsevier, 9th edition, 2007. 5. Lan A. Glover and Peter M. Grant, “Digital communications,” 2nd edition, Pearson education, 2008 6. Richard Van Nee & Ramjee Prasad., ‘OFDM for Multimedia Communications’ Artech House Publication, 2001 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6207** | | **WIRELESS NETWORKS** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To learn about the architecture, protocol stack, specifications and characteristics of Wi-Fi, WiMAX, WPAN, wireless internet.   **COURSE OUTCOMES:**   * Latest technologies in wireless networks especially the architecture, protocol stack and their network specification   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction: ATM reference model - addressing - signaling - routing- ATM Adaptation Layer (AAL) - traffic classes - traffic management and quality of service - traffic descriptor - traffic shaping - management and control - traffic and congestion control - network status monitoring and control - user/ network signaling - internetworking with ATM - IP over ATM - multiprotocol over ATM | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Wireless networks-wireless local loop (WLL) and LMDS, Wireless local area networks (WLANs), IEEE 802.11 Architecture & services, MAC, physical layer, IEEE 802.11a,802.11b standards , HIPERLAN, WPANs –Bluetooth, ZigBee, Introduction: WiMAX overview - competing technologies - overview of the physical layer - PMP mode - mesh mode - multihop relay mode | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Fixed-Assignment access for Voice Oriented Networks, Random Access for Data Oriented Networks, Integration of voice and data traffic, Power Control and power saving mechanisms, Handoff and Roaming Support, Security in wireless networks | | | | 7 |
| **IV** | 3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture,4G features and challenges, Technology path, IMS Architecture , UWB overview - time hopping UWB - direct sequence UWB - multiband UWB LTE– An overview - system model - specifications - frame structure - comparison with broadband technologies | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1.William Stallings, “Wireless Communications and networks”, Pearson/Prentice Hall of India,2nd Ed.,2007.2  2.Dharma Prakash Agrawal & Qing-An Zeng, “Introduction to Wireless and Mobile Systems”,Thomson India Edition,2nd Ed.,2007  3. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", Pearson Education Asia, 2002.  4. Ramjee Prasad and Luis Munoz,“WLANs and WPANs towards 4G wireless”, Artech House, 2003  5.Lumit Kasera and Pankaj Sethi, “ATM Networks: Concepts and Protocols”, Tata McGraw Hill, 2007.  6.Jeffrey G. Andrews, Arunabha Ghosh and Rias Muhamed, “Fundamentals of WiMAX Understanding Broadband Wireless Networking”, Prentice Hall of India, 2008  7.Amitabha Ghosh and Rapeepat Ratasuk, “Essentials of LTE and LTE-A”, Cambridge University, 2011.  8. David Tung Chong Wong, Peng-Yong Kong, Ying-Chang Liang, Kee Chaing Chua and Jon W. Mark, “Wireless Broadband Networks”, John Wiley and Sons, 2009.  9. Dr Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, “Wireless and Mobile Networks: Concepts and Protocols”, Wiley India, 2010 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6211** | | **Coding Theory (ELECTIVE 1)** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Understand the concept of amount of information, entropy, channel capacity, error-detection and error-correction codes, block coding, convolutional coding, and Viterbi decoding algorithm.   **COURSE OUTCOMES:**   * Students will be expected to develop the skills to apply Information Theory and Coding for Engineering applications, * Apply Data Compression, Design Error Correcting Codes.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **Introduction to Algebra**: Groups Fields Binary Field Arithmetic, Construction of Galois Field GF (2m) and its basic properties. Computation using Galois Field GF (2m) Arithmetic Vector spaces.  **Linear Block Codes**: Generator and Parity check Matrices, Encoding circuits, Syndrome and Error Detection, Minimum Distance Considerations, Error detecting and Error correcting capabilities, Standard array and Syndrome decoding, Decoding circuits, Hamming Codes. Reed Muller codes, The (24, 12) Golay code, Product codes and Interleaved codes | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Cyclic Codes**: Introduction Generator and Parity check Polynomials, Encoding using Multiplication circuit. Systematic Cyclic codes, Encoding using Feedback shift register circuits. Generator matrix for Cyclic codes. Syndrome computation and Error detection, Meggit decoder. Error trapping decoding. Cyclic Hamming codes, Golay code, shortened cyclic codes. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **BCH Codes**: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction. Non-binary BCH codes: q-array Linear Block Codes. Primitive BCH codes over GF (q) Reed-Solomon Codes, Decoding of Non-Binary BCH and RS codes: The Berlekamp’s-Massey Algorithm | | | | 7 |
| **IV** | **Convolutional Codes:**  Encoding of Convolutional codes Structural properties, Distance properties. Viterbi Decoding Algorithm for decoding, Soft -output Viterbi Algorithm, Stack and Fano sequential decoding Algorithms, Majority logic decoding  **Concatenated Codes & Turbo Codes:**  Single level Concatenated codes, Multilevel Concatenated codes,Soft decision Multistage decoding, Concatenated coding schemes with Convolution inner codes, Introduction to turbo coding and their distance properties, Design of Turbo codes | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Shu Lin & Daniel J. Costello, Jr '' Error Control Coding'' Pearson/ Prentice HallSecond Edition, 2004. (Major Reference)  2. Blahut, R. E. ''Theory and Practice of Error Control  Codes'' Addison Wesley, 1984  3. F. J. Mac Williams and N.J.A. Slone, ''The theory of error correcting codes''North Holland, 1977 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6213** | | **MULTIMEDIA COMMUNICATION(ELECTIVE 1)** | **2-1-0-3** | 2015 | |
| COURSE OBJECTIVES:   * Introduction to Multimedia Applications and Standards,Digital Image, Video and Audio Compression * Networking technology for multimedia   **COURSE OUTCOMES:**   * The use of IP networks for multimedia communication. * Apply Multimedia standards for audio, video and image   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction, Evolution & convergence- Technology & Standardization Framework- ISO/IEC MPEG-21 Multimedia framework-Internet standards-MPEG applications- TV & Storage media-multimedia conferencing-Digital radio & video broadcasting-DVB &Internet-Mobile services & applications | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Audio and video compression: Digital audio- audio compression techniques - μ Law and A Law companding, ADPCM. MPEG Audio-layers, audio compression algorithms, MPEG- 2,MPEG 4,MPEG -7 Video Compression-Video signal components - Video compression techniques – MPEG Video Coding– Motion Compensation – H.261 , H.263 Standard , MPEG4 ,MPEG 7 and H.264 and H.265 codecs | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Multimedia across IP Networks-audio and video transmission across IP network-Multimedia across DSLs-VODSL architecture, voice services-Multimedia across ADSL-Multimedia Across Wireless, Speech transmission in GSM,Video across GSM, Mobile ATM, Mobile IP, Wireless multimedia delivery | | | | 7 |
| **IV** | Network services & protocol for multimedia communications: LAN, Internet Technologies and protocols-multicast extension- QoS-protocols for multimedia transmission -Internet telephony-signalling protocols-Internet multimedia content distribution | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1.Introduction to Multimedia Communications Applications, Middleware and networking by K.R.Rao, Zoran Bojkovic, Dragorad Milovanovic, Wiley & sons publications, 2006  2. Ranjan Parekh, “Principles Of Multimedia”, TMH, 2006  3. [Ze-Nian Li](http://link.springer.com/search?facet-creator=%22Ze-Nian+Li%22), [Mark S. Drew](http://link.springer.com/search?facet-creator=%22Mark+S.+Drew%22), [Jiangchuan Liu](http://link.springer.com/search?facet-creator=%22Jiangchuan+Liu%22) ,”Fundamentals Of Multimedia”,Springler Second Edition, 2004  4. Tay Vaughan, “Multimedia: Making It Work”, Fifth Edition, Tata Mcgraw-Hill | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6215** | | **ADVANCED OPTICAL COMMUNICATION(ELECTIVE 1)** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Tointroduce  the  variousopticalfibremodes,Modal analysis and modal equations, BER and Q-factor measurements & BER analysis * To learn the basic elements of optical fibre transmission link, Point-to-point link , Rise time budget, power budget & Power penalties, the different kind of modulation & the concept of Solutions   **COURSE OUTCOMES:**   * Design an optical receiver & analog receivers. Apply digital transmission in optical fiber systems. * Perform Power budget calculations for fiber links   .  **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **INTRODUCTION**  Guided optical communication – wave representation in a dielectric slab wave guide, fiber- a cylindrical wave guide. Modes overview, modal concepts, Maxwell’s equations in a circularly symmetric step index optical fiber, waveguide equations. Modal analysis, modal equations, modes in SI fibers, LP modes. Power flow in SI fiber, mode field diameter, wavelength stabilization. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **OPTICAL SOURCES AND DETECTORS**  Optical sources –Laser diodes – modes and threshold conditions, Rate equations, external quantum efficiency, resonant frequency, radiation pattern. Light source linearity and reliability considerations. Photo detector- noise, noise sources, response time, typical receiver configurations (high impedance and Trans impedance receivers). | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **OPTICAL RECEIVERS**  Digital receivers – probability error, receiver sensitivity, quantum limit, BER and Q-factor measurements. Coherent detection – concepts, homodyne and heterodyne reception, BER comparison. Bust mode receiver. Analog receivers. Point-to-point link. Rise time budget, power budget. Power penalties. Error control. | | | | 7 |
| **IV** | **OPTICAL COMPONENTS**  Fiber grating filters – basics, FBG analysis and applications. Dielectric thin film filters, phased-array based devices, diffraction gratings. Active optical components – MEMs, variable optical attenuators, tunable optical filters, dynamic gain equalizers, optical add/drop multiplexers, polarization and dispersion controllers. Self phase modulation, cross phase modulation, four wave mixing, FWM mitigation, wave length convertors. Solitons – concept, parameters, width and spacing. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Gerd Keiser, “Optical fibre communications”, TMH, 4th Edition, 2008. 2. Harold Kolimbiris, “Fiber optics communications”, Pearson Education, 2nd Edition, 2009. 3. Govind P Agrawal, “Fiber optic communication systems”, 4th Edition, John Wiley, 2010. 4. J.M. Senior, “Optical fibre communications”, Pearson education, 3rd Edition, 2009. 5. Paul Eliot Green, “Fiber optic Networks”, Prentice Hall, NJ, 1993. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6277** | | RESEARCH METHODOLOGY | 1-1-0-2 | 2015 | |
| COURSE OBJECTIVES:   * To Aware of the research process. * Familiarize the tools and skills to investigate a research. * Preparation of an effective report.   .  **COURSE OUTCOMES:**   * Able to do research in a systematic way. * Effective use of appropriate tools for samples and data collection. * Write research proposals and reports.   **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 | | | | 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. Scale classification and types. Measurement of validity, reliability and practicality. | | | | 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.– standard error of the estimate. Testing goodness of fit. Brief introduction to non parametric tests, factor analysis, discriminant analysis and path analysis (description only). | | | | 4 |
| **IV** | Meaning of interpretation and inference: importance and care for interpreting results. Presentation of reports: structure and style. Parts of a research report. Guidelines for writing research papers and reports –. Ethics in research. Use of computers and internet in research.  **Case Study:** Familiarization of Latex software should be included. This will help the studentsto prepare the Reports. Students have to go through a case study by taking some particular samples and conclude with some hypothesis. A Report of the same have to be submitted by the student at the end of this course. | | | | 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   1. Hand Book of Research Methodology : M N Borse, Sree Nivas Publications, Jaipur, 2004 2. Business Research Methods: William G Zikmund, South – Western Ltd, 2003 3. Research Methods in Social Science: P K Majumdar, Viva Books Pvt Ltd, New Delhi, 2005 4. Analyzing Quantitative Data: Norman Blaikie, SAGE Publications , London, 2003 | | | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 6291** | **COMMUNICATION SYSTEM DESIGN LAB& MICROWAVE ENGG& FIBRE OPTICS LAB** | 0-0-2-1 | 2015 |
| COURSE OBJECTIVES:   * To experiment the concepts introduced in the core and elective courses offered this semester with the help of simulation tools and related hardware.   **Suggested flow of experiments COURSE OUTCOMES:**   * Students will be able to take up and design advanced communication systems | | | |
| Suggested flow of experiments (18hrs) | | | |
| (These are minimum requirements; Topics could be added in concurrence with the syllabus of core and elective subjects)   * Generation of discrete time i.i.d. random processes with different distributions (Bernoulli, Binomial, Geometric, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Rician etc) * Visualization of Central Limit Theorem, * Whitening Filter. * Implementation of digital modulation schemes and performance comparison, * Constellation diagrams, Simulation of BER curves for the various schemes, comparison with analytical results. * Implementation of Matched filter, * Correlation receiver & Equalizer. * Communication System Design for Band limited Channels - Signal Design for Zero ISI and Controlled ISI - Partial Response Signalling. * Analog & Digital Optical link setup/ different modulation and demodulation schemes using fiber optical links(FM/PWM/PPM) * Study of different antenna patterns | | | |
| **INTERNAL TEST** | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6202** | | **ADVANCED RADIATION SYTEMS** | 3-1-0-4 | 2015 | |
| COURSE OBJECTIVES:   * To learn the antenna radiation concepts, different types of antenna and its   design methodology  **COURSE OUTCOMES:**   * Students able to design different types of antenna   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (36hrs) | | | | HRS |
| **I** | **Concept of radiation**  Radiation patterns- near and far regions- reciprocity theorem- antenna parameters- antenna arrays- Friss transmission equations- radiation integrals- auxiliary potential functions. | | | | 9 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Aperture and Micro strip Antenna**  Huygens’s principle-radiation from rectangular and circular aperture- uniform aperture distribution on an infinite ground plane- Fourier transform in aperture antenna theory-radiation through aperture in an absorbing screen- Babinet’s principle, Salient features of microstrip antenna-advantages-limitations-applications-rectangular microstrip antenna-feed methods-characteristics of microstrip antenna-transmission line model-Computer Aided Design of microstrip antenna | | | | 9 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **Broadband antennas**  principles-design and properties of log periodic- yagiuda- frequency independent antennas—loop antennas- helical antenna- biconical antenna-broadcast antenna- spiral and slot antenna  Horn antenna- reflector antenna-aperture blockage and design considerations | | | | 9 |
| **IV** | **Modern antennas**  Vivaldi antenna-UWB antenna-leaky wave antenna-plasma antenna-RFID antenna- reconfigurable antenna-plasma antenna- Antenna applications: mobile phone antenna-base station-handset antenna- antennas for biomedical applications-antennas in communications systems | | | | 9 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Balanis C A “antenna theory “2nd edition, wiley,2003  2. J.D Krauss,”antennas “, Tata McGraw Hill, 2006  3. Elliot,”antenna theory and design”, IEEEpress,2003  4. Constantine A Balanis,”modern antenna Handbook”  5. Jim R James ,P.S.Hall “Handbook of microstrip antenna”  6. I J Bahl and P.Bhartia,”microstrp antenna”  7. W.L Stutzman and G A Thiele,”antenna theory and design “, 2nd edition ,John wiely and sons Inc,1998 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6204** | | **MULTI CARRIER COMMUNICATION** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Understand the basic principles of Channel Characteristics, estimation, synchronisation   PAPR influence in OFDM  .  **COURSE OUTCOMES:**  At the end of the course the student will be able to   * Designing the promising techniques for implementation of future generations of wideband, broadband and ultra-wideband systems   **SYLLABUS** | | | | | |
| 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 | | | | 7 |
| **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. | | | | 7 |
| **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. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6206** | | **ADAPTIVE SIGNAL PROCESSING** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * The problems & solutions in processing signals in changing environments * Understanding the performance analysis of adaptive filters o improve the performance over static, fixed filtering techniques   **COURSE OUTCOMES:**  At the end of the course the student will be able   * Provide the ability to understand and apply the techniques to simulated signals in an unknown environment in order to gain improvements in performance   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | The filtering problem -Linear optimum filters -Adaptive filters -Linear Filter structures -Approaches -Linear Optimum Filtering Problem Statement -Orthogonality Principle -MMSE -Wiener-Hopf Equations -Error performance surface. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Forward Linear Prediction-Backward Linear Prediction –Levinson Durbin Algorithm -Properties of Prediction Error Filters -Steepest Descent Algorithm applied to the Wiener Filter -Stability of the Steepest Descent Algorithm-Virtue and Limitation of the Steepest Descent Algorithm. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | LMS adaptation algorithm -Applications: Adaptive Noise cancelling, Adaptive Beamforming-Comparison of LMS algorithm with Steepest Descent Algorithm -Convergence analysis of LMS filter -Robustness of LMS Filter -Normalized LMS algorithm–Block LMS Algorithm–Frequency domain Adaptive filters. | | | | 7 |
| **IV** | Method of Least Squares -Normal Equations and Linear Least Squares Filters –Time average Correlation Matrix -Matrix Inversion Lemma -RLS algorithm -Convergence Analysis of RLS Algorithm -Kalman filtering -Innovation Process- Estimation of the state using the Innovation Process. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Simon Haykin, Adaptive Filter Theory, Pearson Education.  2. A. Sayed, Adaptive Filters, Wiley-IEEE Press.  3. B. Farhang-Boroujeny, Adaptive Filters: Theory and Applications, Wiley.  4. John R. Treichler, C. Richard Johnson, Michael G. Larimore, Theory and Design of Adaptive Filters, Prentice-Hall of India, 2002 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6222** | | **Wimax -Broadband wireless Technology** (ELECTIVE 2) | 2-1-0-3 | 2015 | |
| **COURSE OBJECTIVES:**   * Introduce Wimax standard, Architecture & protocol * Concepts of Bandwidth & mobility management * Link& system level performance analysis   **COURSE OUTCOMES:**   * Application of OFDM to 4G * Evaluate the technological evolution from 2G to 4G technologies and their effects on channel capacities (bandwidth) * Determine the ideal management techniques for broadband networks   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction**:** Introduction to Broad band wireless access-Wireless networks & Broadband wireless Access Applications-Protocol Layers and Topologies-Frequency utilization & system profile | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | WiMax Physical & MAC Layer:Digital Modulation, OFDM, OFDMA & its variant SOFDMA, Subcarrier permutations in WIMAX OFDMA physical Layer, Coding, Convergence Sublayer, MAC functions & frames, Band width management & QoS,Feature for performance enhancements, Power saving operations & mobility management | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Wimax Network Architecture: Design Principles-Network reference model-Protocol layering across the network-Network discovery & selection-Authentication, security & QoS architecture-mobility management | | | | 7 |
| **IV** | Link level & system level performance: Methodology for link & system level simulation- channel modeling-Channel performance of Wimax-benefits of multiple antenna techniques-Efficient use of radio resources | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  . 1. Fundamentals of WiMAX: Understanding Broadband Wireless Networking   By Jeffrey G. Andrews, Arunabha Ghosh, Rias Muhamed  2. WiMAX: Technology for Broadband Wireless Access By Professor Loutfi Nuaymi wiley  3. Fundamentals of WiMAX: Understanding Broadband Wireless Networking  By Andrews,[Pearson Education India](https://books.google.co.in/url?client=ca-print-pearson_india&format=googleprint&num=0&id=wMlTYPuqnmIC&q=http://pearson.vrvbookshop.com/book/fundamentals-wimax-jeffrey-g-andrews/9788131726358&usg=AFQjCNFxR1d8HO9IA4fzbTOfKM9-gXjvkg&source=gbs_buy_r) 4. Mobile WiMAX: Toward Broadband Wireless Metropolitan Area Networks  edited by Yan Zhang, Hsiao-Hwa Chen CRC Press, 10-Dec-2007 - [Technology & Engineering](https://www.google.co.in/search?tbo=p&tbm=bks&q=subject:%22Technology+%26+Engineering%22&source=gbs_ge_summary_r&cad=0)  5.Mobile WiMAX: A Systems Approach to Understanding IEEE 802.16m Radio Access .By Sassan Ahmadi, Academic Press, 22-Dec-2010 - [Technology & Engineering](https://www.google.co.in/search?tbo=p&tbm=bks&q=subject:%22Technology+%26+Engineering%22&source=gbs_ge_summary_r&cad=0) | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6224** | | **OPTICAL NETWORKS**  (ELECTIVE 2) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To provide a comprehensive understanding of optical communication systems and networks * To get a basic understanding of physical properties of optical networks, optical components and optical node design, optical switching methods and networking techniques, circuit, packet, hybrid, burst and flow   **COURSE OUTCOMES:**  At the end of the course the student will be able to   * Applying theory of Optical network architectures ranging from optical access networks to backbone optical transport networks for engineering applications * Approaches and methodologies of optical network design optimization;   Techniques of optical network survivability  **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction to Optical Components and Routing: Introduction to WDM optical networks-WDM networks architectures- issues in wavelength routed networks. Wavelength routing algorithms: Introduction- Classification of RWA algorithms-RWA algorithms fairness and admission control- distributed control protocols, OTDM, multiplexing and demultiplexing, optical logic gates, synchronization, broadcast OTDM network, OTDM test beds | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Optical Switching: Optical Burst Switching OBS node architecture-burst switching protocols-wavelength channel scheduling. Optical packet switching and access networks: Introduction-optical packet switching node architecture- contention resolution protocols. Enhanced HFC-FTTC – PON architectures | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Optical Networks: Client Layers of the Optical Layer- Optical packet switching, Synchronous Optical Network /Synchronous Digital Hierarchy (SONET/SDH), Ethernet - multiprotocol label switching -resilient packet ring - storage area networks. ATM, functions, quality, control, layers, enterprise systems connection(ESCON), fiber channel, high performance parallel interface(HIPPI), optical transport network(OTN ),automatically switched optical network(ASON) models | | | | 7 |
| **IV** | Control and Management-Network Management Functions, Optical Layer Services and Interfacing, Performance and Fault Management, Optical Safety, Network Survivability, Protection in SONET/ SDH - protection in client layer - need for optical layer protection - optical layer protection schemes. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1.Rajiv Ram swami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective, 3rd  Edition, Morgan Kaufmann Publishers, 2007  2 C. Siva Ram Murthy and Mohan Gurusamy, “WDM Optical Networks: Concepts, Design and  Algorithms,” Prentice Hall of India, 2008  3 Richard D. J. Van Nee and Ramjee Prasad, “OFDM for Wireless Multimedia Communication”, Artech House, 1999.  4 Lu Ruan, Dingzhu Du, “Optical Networks: Recent Advances”, Springer, 2001.  5, Hussein T. Mouftah, Pin-Han Ho, “Optical networks: architecture and survivability”springler, 2002. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6226** | | **PRINCIPLES OF SECURE COMMUNICATION** (ELECTIVE 2) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Study the various security attacks, data security and network security algorithms and wireless security mechanism   **COURSE OUTCOMES:**   * Various symmetric and asymmetric cryptographic techniques, authentication mechanism and network security   **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 - Non-linear combination of LFSRs - Boolean functions | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Private key and Public key cryptosystems - One way functions - Discrete log problem – Factorization problem - 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 - Discrete logarithm problem on EC - Elliptic curve cryptography - Diffie Hellmann key exchange over EC - Elgamal encryption over EC – ECDSA | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1.Douglas A. Stinson, “Cryptography, Theory and Practice”, 2nd edition, Chapman & Hall, CRC PressCompany, Washington  2.William Stallings, “ Cryptography and Network Security”, 3rd edition, Pearson Education  3.Lawrence C. Washington, “ Elliptic Curves”, Chapman & Hall, CRC Press Company, Washington.  4.David S. Dummit, Richard M. Foote, “ Abstract Algebra”, John Wiley & Sons  5.Evangelos Kranakis, “ Primality and Cryptography”, John Wiley & Sons 4.Rainer A. Ruppel, “ Analysis and Design of Stream Ciphers”, Springer Verlag | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6232** | | **RF MEMS(ELECTIVE 3)** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * The course is designed to familiarize the student with the functions and   applications of MEMS  **COURSE OUTCOMES:**   * Students will able to design different type of MEMS based devices, circuits   and subsystems.  **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | New trends in Engineering and Science: Micro and Nanoscale systems -Introduction to Design of MEMS and NEMS-Overview of Nano and Micro electromechanical Systems, Applications of Microand Nano electromechanical systems- Micro electromechanical systems, devices and structures. Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metal | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | MEMS inductors and capacitors. Micromachined inductor. Effect of inductor layout. Modeling and design issues of planar inductor. Gap tuning and area tuning capacitors. Dielectric tunable capacitors. Micromachined RF filters. Modeling of mechanical filters. Electrostatic comb drive. Microechanical filters using comb drives. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor | | | | 7 |
| **IV** | MEMS phase shifters. Types. Limitations. Switched delay lines. Micromachined transmission lines. Coplanar lines. Micromachined directional coupler and mixer-Micromachined antennas. Microstrip antennas – design parameters. Micromachining to improve performance. Reconfigurable antennas | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1 V.K.Varadan etal, RF MEMS and their Applications, Wiley, 2003  2. Stephen D. Senturia,” Micro system Design”, Kluwer Academic Publishers, 2001  3. H.J.D.Santos, RF MEMS Circuit Design for Wireless Communications, Artech House , 2002.  4. G.M.Rebeiz , RF MEMS Theory, Design and Technology, wiley , 2003.  5.Stephen D Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2001.  6. Marc Madou, “Fundamentals of Microfabrication”, CRC Press, 1997  7. Tai Ran Hsu ,”MEMS and Microsystems Design and Manufacture” ,Tata Mcraw Hill, 2002.  8. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006,  9. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures” CRC 2002 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6234** | | **CDMA TECHNOLOGY(ELECTIVE3)** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Introduce CDMA concept, link structure & call processing * Concepts of CDMA Design engineering * Performance analysis of CDMA system   **COURSE OUTCOMES:**   * Basic design concept of CDMA systems pave the way for thinking next generation CDMA with high speed.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | **The CDMA concept:** Need for spread spectrum communication – Spreading codes –Direct sequence and Frequency hopping spread spectrum communication system –Spread spectrum performance – Basic DS CDMA – Elements – RAKE receiver – Power control – Soft handover – Inter frequency handover – Multi user detection – Capacity – Effects of loading, sectorisation and voice activity. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | **Link structure and Call processing:** Asymmetric links - Forward link – Pilot channel – Sync channel – Paging channel – Traffic channel – Modulator – Reversing access channel – Traffic channel – Call processing states – Initialization state – Idle state – Access state – Traffic channel state. | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | **CDMA Design Engineering:** Forward Link analysis – Pilot channel – Traffic channel – Reverse link – Traffic channel – Reverse link rise – Frequency reuse factor - PN offset planning – Short PN sequence – Co PN offset – Adjacent PN offset. | | | | 7 |
| **IV** | **CDMA Performance and Traffic engineering**: Channel supervision-Power control parameters - Search window sizes - Field optimization – Traffic intensity – Loads – Grade of service – Soft and hard blocking.  Next Generation CDMA**:** Physical channel – Multirate design – Spreading technique – Advanced error control techniques – Coherent detection – Inter operability in next generation CDMA – Multicarrier CDMA option – Forward link – Reverse link. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. Samuel C Yang, “CDMA RF System Engineering”, - Artech House Mobile Communication Library , 1998.  2. John B.. Groe and Lawrence E. Larson, “CDMA Mobile Radio Design”, Artech house 2000.  3. Kamil SH.Zingangirav, “Theory of Code Division Multiple Access  Communication”, IEEE press – Wiley Interscience, 2004.  4.Code Division Multiple Access (CDMA) R. Michael Buehrer Morgan & Claypool Publishers, 2006  5. Samuel C Yang, 3G CDMA2000 Wireless system Engineering, - Artech House Mobile Communication Library, 2004 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 6236** | | **WIRELESS ADHOC AND SENSOR NETWORKS(ELECTIVE 3)** | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Understanding of wireless ad-hoc and sensor networks * Enable them to recognise the wide range of applicability of these networks, and provide them with an understanding of the major design issues, including topics such as protocol mechanisms and resource constraints..   **COURSE OUTCOMES:**   * Able to understand and explain protocol design issues (especially energy-efficiency) and protocol designs for wireless sensor networks * Critique protocol designs in terms of their energy-efficiency * To design and implement sensor network protocols in the nesC/TinyOS environment. * To set up and evaluate measurements of protocol performance in wireless sensor networks.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Ad hoc Wireless Networks – Heterogeneity in Mobile Devices – Wireless Sensor Networks – Traffic Profiles – Types of Ad hoc Mobile Communications – Types of Mobile Host Movements – Challenges Facing Ad hoc Mobile Networks – Ad hoc wireless Internet . Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On–Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) –Location–Aided Routing (LAR) – Power–Aware Routing (PAR) – Zone Routing Protocol (ZRP). | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols –Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols– Mesh–Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy–Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing – Comparisons of Multicast Routing Protocols - Design Goals of a Transport Layer Protocol for Adhoc Wireless Networks - Issues and Challenges in Providing QoS in Ad hoc Wireless Networks- Need for Energy Management in Ad hoc Wireless Networks | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | SENSOR NETWORKS **:** Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks. , physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management - MAC protocols – fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols Schedule-based protocols - SMAC, BMAC, Traffic-adaptive medium access protocol (TRAMA), Link Layer protocols – fundamentals task and requirements, error control, framing, link management. | | | | 7 |
| **IV** | **Routing Protocols:** Gossiping and agent-based uni-cast forwarding, Energy-efficient unicast, Broadcast and multicast, geographic routing, mobile nodes, Data-centric routing – SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing – COUGAR, ACQUIRE, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  . 1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004.  2. C. K. Toh, “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.  3. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.  4. Kazem Sohraby, Daniel Minoli and Taieb Znati, “Wireless Sensor Networks Technology- Protocols and Applications”, John Wiley & Sons, 2007.  5. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks: an information processing approach”, Else vier publication, 2004.  6. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, “Wireless Sensor Networks”, Springer publication, 2004.  7. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006.  8. K.Akkaya and M.Younis, “ A Survey of routing protocols in wireless sensor networks”, Elsevier Adhoc Network Journal, Vol.3, no.3,pp. 325-349, 2005.  9. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, “Wireless sensor networks: a survey”, computer networks, Elsevier, 2002, 394 - 422.  10. Jamal N. Al-karaki, Ahmed E. Kamal, “Routing Techniques in Wireless sensor networks: A  Survey”, IEEE wireless communication, December 2004, 6 – 28. | | | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 6266** | SEMINAR I | 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. | | | |
| Each student should present a seminar on any topic related to the core/elective courses offered in the first semester of the M. Tech. Program. The selected topic should be based on the papers published in reputed international journals preferably IEEE The selected paper should be approved by the Program Coordinator/Faculty member before presentation. 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.  . | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 6288** | **MINI PROJECT** | 0-0-4-2 | 2015 |
| COURSE OBJECTIVES:   * To improve professional competency, research aptitude and team work skills. * To motive and energize talent. * To develop an aptitude to deliver commitments and manage time and stress pressures.   **GUIDELINES:** | | | |
| The mini project is designed to develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, academic institutions  and communication engineering research. 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. The topic should be approved by the Programme Co-coordinator / Faculty member before carrying out the work. For external projects, students should obtain prior permission after submitting the details of the guide and synopsis of the work. The project guide should have a minimum qualification of ME/ M.Tech in Communication engineering or related fields. 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 for end semester assessment. Marks will be awarded based on the report and their performance during presentations and demonstrations. Publishing the work in Conference Proceedings/Journals with National/International status with the consent of the guide will carry an additional weightage in the evaluation process | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 6292** | **NETWORK SIMULATION LAB** | 0-0-2-1 | 2015 |
| COURSE OBJECTIVES:   * Testing of Concepts introduced in Wireless Communication, Communication Networks, Coding Theory and Wireless Networks courses * **COURSE OUTCOMES:** * Students will be able to design wireless communication systems | | | |
| Suggested flow of experiments (18 hrs) | | | |
| (These are minimum requirements; Topics could be added in concurrence with the syllabus of elective subjects offered)  Scheduling and Queuing Disciplines in Packet Switched Networks: FIFO, Fair Queuing,  RED-TCP Performance: with and without RED.  Wireless Medium Access Control: MAC layer 802.11: CSMA/CA, RTS/CTS modeSimple Sensor/Mobile Ad hoc Networks, Simulation and Evaluation of MAC, Routing protocols using Network simulators, performance evaluation of routing protocols, topology simulation, simulation of Adhoc networks, throughput of the networkOFDM system simulation, BER performance in fading channels, Channel estimation and Synchronization in OFDMChannel Coding: | | | |
| **INTERNAL TEST** | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 7241** | | **COGNITIVE RADIO** (ELECTIVE 4) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation. * Enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.   **COURSE OUTCOMES:**   * To expose the student to the evolving next generation wireless networks and their associated.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction & Economics of cognitive radio-Cognitive Networks basics-Architecture –Functions, Components, Design rules-Cognitive Cycles- Propagation issues for Cognitive radio | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | SDR & Cognitive Radio relations- SDR Architecture-software tunable analog radio components-Antenna systems-reconfigurable digital radio technologies-Basic digital radio components-Efficiency and coexistence strategies for cognitive radio | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Spectrum sensing for Cognitive radio applications-challenges-methods-cooperative and external sensing-frequency and wireless standards-Cognitive wireless network model-location estimation & sensing-Mobility management-Applications | | | | 7 |
| **IV** | OFDM based Cognitive Radio- Link adaptation in OFDM based Cognitive radio Systems-UWB Cognitive Radio | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1.Ahmed Khattab, Dmitri Perkins, Magdy Bayoumi Cognitive Radio Networks: From Theory to Practice, springer  2.Hüseyin Arslan, Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, springer 3. Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor ,Principles of Cognitive Radio, Cambridge University 4. Hrishikesh Venkataraman, Gabriel-Miro Muntea, Cognitive Radio and its Application for Next Generation Cellular and Wireless Networks, Springer  5. Linda Doyle, Essentials of Cognitive Radio, Cambridge University  6. Hsiao-Hwa Chen, Mohsen Guizani, Next Generation Wireless Systems and Networks, Wiley&sons | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 7243** | | **CELLULAR MOBILECOMMUNICATION**(ELECTIVE 4) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Be acquainted with the role of cellular and mobile communications in frequency management issues. * Be acquainted with different interference factors influencing cellular and mobile communications. * Be able to efficiently use the background behind developing different path loss and/or radio coverage in cellular environment.   **COURSE OUTCOMES:**   * Students will learn about introduction to cellular mobile system, basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning of cellular system, channel interference, frequency management and channel Assignment * Performance analysis of cellular system   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction To Wireless Mobile Communications: History and evolution of mobile radio systems. Types of mobile wireless services/systems- Cellular, WLL, Paging, Satellite systems, Standards, Future trends in personal wireless systems | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Cellular Concept and System Design Fundamentals: Cellular concept and frequency reuse, Multiple Access Schemes, channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations. Frequency plans: Channelized Schemes and Frequency Hopping | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Mobile Radio Propagation: Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and Base band impulse respond models, parameters of mobile multipath channels, Antenna systems in mobile radio. Mobile Radio Interference: Co-Channel and Adjacent Channel Interference, Intermodulation, Intersymbol Interference. | | | | 7 |
| **IV** | Modulation and Signal Processing: Analog and digital modulation techniques, Performance of various modulation techniques-Spectral efficiency, Error-rate, Power Amplification Equalizing Rake receiver concepts, Diversity and space-time processing, Speech coding and channel coding. Spread Spectrum. | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1. K.Feher, Wireless digital communications, PHI, New Delhi,1995  2. T.S.Rappaport, Wireless digital communications; Principles and practice, Prentice Hall, NJ, 1996.  3. W.C.Y.Lee, Mobile communications engineering: Theory and Applications, Second Edition,  McGraw Hill, New York.19908.  4. Schiller, Mobile Communications; Pearson Education Asia Ltd., 2000.  5. R Steele and L Manzo, “Mobile Radio communications”, John Wiley, 1992, 2nd Edition.  6. G H Stubber, “Principles of Mobile Communications”, Kluwer, 1996. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 7245** | | **VLSI FOR WIRELESSCOMMUNICATION**  (ELECTIVE 4) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Study the design concepts of low noise amplifiers, various types of mixers designed for wireless communication, design PLL and VCO, understand the concepts of CDMA in wireless communication * Study the concept of wireless system on chip   **COURSE OUTCOMES:**   * Identify the characteristics of mixers designed for wireless communication * solve technical problems in design PLL and VCO   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | COMPONENTS AND DEVICES: Integrated inductors, resistors, MOSFET and BJT, AMPLIFIER DESIGN Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain Control Amplifiers – Power Amplifiers | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | MIXERS :Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise - A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | FREQUENCYSYNTHESIZERS Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example((DECT Application). equalizers and transceivers,Data converters in communications | | | | 7 |
| **IV** | IMPLEMENTATIONS: Design of Digital signal processing blocks- FFT, IFFT, FIR filters, VLSI architecture for Multitier Wireless System - Hardware Design Issues for a Next generation CDMA System | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**  1.Bosco H. Leung “VLSI for Wireless Communication”, Prentice Hall, 2002  2 Emad N Farag, Mohamed I. Elmasry “Mixed Signal VLSI Wireless Design - Circuits and Systems”, Kluwer Academic Publishers, 2000  3. Bob Zeidman, “Designing with CPLDs and FPGAs”, CMP, 2002.  4. Mitra S K, “Digital Signal Processing”, Tata McGraw Hill, 2005.  5. Joseph C Liberti.Jr and Theodore S Rappaport, “Smart Antennas for Wireless Communication: IS-95 and Third Generation CDMA Applications”, Prentice Hall 1999.  6. <http://citeseerx.ist.psu.edu>  7. http://www.ece.rice.edu | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 7251** | | **SMART ANTENNAS** (ELECTIVE 5) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * Gain an understanding and experience with smart antenna environments, algorithms and implementation. * The theory and implementation of smart antennas is explored including electromagnetic principles, array signal processing, random processes, channel characterization, spectral estimation, and adaptive algorithms.   **COURSE OUTCOMES:**   * Evaluate a system requirement for implementation of an appropriate Smart Antenna implementation Understand how adaptive arrays can be applied to moderm communication systems and remote sensing systems.  1. Design a Smart Antenna or sensor system and be able to evaluate performance.  Gain an understanding of the operation and application of spatial filtering accomplished by adaptive array antenna systems.   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction To Smart Antennas: Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Access (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | DOA Estimation Fundamentals :Introduction The Array Response Vector, Received Signal Model, The Subspace-Based Data Model, Signal Autocovariance Matrices ,Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon’s Minimum Variance Method, Subspace Approach to DOA Estimation ,The MUSIC Algorithm, The ESPRIT Algorithm, Uniqueness of DOA Estimates | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Beamforming Fundamentals {The Classical Beam former-Statistically Optimum BeamformingWeight Vectors, The Maximum SNR Beam former, The Multiple Side lobe Canceller and the Maximum, SINR Beam former- Minimum Mean Square Error (MMSE),Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV) , Adaptive Algorithms for Beamforming ,The Least Mean-Square (LMS) Algorithm, The Recursive Least-Squares (RLS) Algorithm | | | | 7 |
| **IV** | Space–Time Processing: Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beamforming, Intersymbol and Co-Channel Suppression, ISI Suppression, CCI Suppression, Joint ISI and CCI Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Single-User Data Rate Limits, Multiple-Users Data Rate Limits, Data Rate Limits Within a Cellular System, MIMO in Wireless Local Area Networks | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Constantine A. Balanis, Panayiotis I. Ioannides, Introduction to Smart Antennas Morgan & Claypool Publishers 2. Ahmed El Zooghby, Smart Antenna Engineering, Artech House   3. M.J. Bronzel, Smart Antennas, John Wiley, 2004  4. T.S.Rappaport & J.C.Liberti, Smart Antennas for Wireless Communication, Prentice  Hall (PTR) , 1999.  5. R.Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001 | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 7253** | | **NETWORK ROUTING ALGORITHMS**  (ELECTIVE 5) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To expose the students to the layered architecture for communication networks and the specific functionality of the network layer. * To enable the student to understand the basic principles of routing and the manner this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network. * To enable the student to understand the different routing algorithms existing and their performance characteristics.   **COURSE OUTCOMES:**   * Identifying a suitable routing algorithm , implementing it and analyzing network performance. * The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications   .  **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Introduction:ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Interior protocol: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing. Mobile - IP Networks  Macro-mobility Protocols, Micro-mobility protocol: Tunnel based: Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII) | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Routing In Optical Wdm Networks:Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Light path Migration, Rerouting Schemes, Algorithms- AG, MWPG. | | | | 7 |
| **IV** | Sensor Networks Routing Protocols & Operating Systems: Gossiping and agent-based uni-cast forwarding, Energy-efficient unicast, Broadcast and multicast, geographic routing, mobile nodes, Data-centric routing – SPIN, Directed Diffusion, Energy aware routing, Gradient-based routing – COUGAR, ACQUIRE, Hierarchical Routing – LEACH, PEGASIS, Location Based Routing – GAF, GEAR, Data aggregation – Various aggregation techniques. Introduction to TinyOS – NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, Emulator TOSSIM | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. William Stallings, ‘ High speed networks and Internets Performance and Quality of Service’, IInd Edition, Pearson Education Asia. Reprint India 2002 2. M. Steen Strub, ‘Routing in Communication network, Prentice –Hall International, Newyork,1995. 3. S. Keshav, ‘An engineering approach to computer networking’ Addison Wesley 1999. 4. William Stallings, ‘High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 1995 5. C.E Perkins, ‘Ad Hoc Networking’, Addison – Wesley, 2001 6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, “ A Survey of mobility Management in Next generation All IP- Based Wireless Systems”, IEEE Wireless Communications Aug.2004, pp 16-27. 7. A.T Campbell et al., “ Comparison of IP Micromobility Protocols,” IEEE Wireless Communications Feb.2002, pp 72-82. 8. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John wiley publication, Jan 2006. 9. K.Akkaya and M.Younis, “ A Survey of routing protocols in wireless sensor networks”, Elsevier Adhoc Network Journal, Vol.3, no.3,pp. 325-349, 2005. 10. Philip Levis, “TinyOS Programming”, 2006 – [www.tinyos.net](http://www.tinyos.net). 11. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, “Wireless sensor networks: a survey”, computer networks, Elsevier, 2002, 394 - 422. 12. Jamal N. Al-karaki, Ahmed E. Kamal, “Routing Techniques in Wireless sensor networks: Asurvey”, IEEE wireless communication, December 2004, 6 – 28. | | | | | |
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| COURSE CODE | | COURSE NAME | L-T-P-C | YEAR | |
| **05EC 7255** | | **MOBILE SATELLITE COMMUNICATION** (ELECTIVE 5) | 2-1-0-3 | 2015 | |
| COURSE OBJECTIVES:   * To understand the fundamentals of orbital mechanics, and be able to calculate key geometric and timing parameters for a variety of common satellite orbits * To understand the various channel impairments, interference issues and practical limitations which exist in satellite communications systems * To take a practical look at the engineering impact of the various satellite components on performance. These include power, size, materials used, and attitude control   **COURSE OUTCOMES:**   * Identify the characteristics of common orbits used by communications and other satellites, and assess launch methods and technologies * Identify the systems required by a communications satellite to function and the tradeoffs and limitations encountered in the design of a communications satellite system * Design link budget for a satellite or other wireless communications link   **SYLLABUS** | | | | | |
| MODULE | COURSE CONTENT (27hrs) | | | | HRS |
| **I** | Satellite Orbits – Satellite Constellations- Kepler’s Laws of motion, Orbital aspects of Satellite Communications-Orbital Mechanics –Equation of orbit – Orbital Elements – Look angle determination – orbital perturbation – Satellite coverage-– sub satellite point – launching procedures and Launch Vehicles. | | | | 7 |
| **INTERNAL TEST 1(Module 1)** | | | | | |
| **II** | Principles of satellite communication: Evolution & growth of communication satellite, Synchronous satellite, Satellite frequency allocation & Band spectrum, Advantages of satellite communication, Active & Passive satellite.  Communication Satellite Link design: Introduction, General link design equations, System noise temperature, C/N & G/T ratio, Atmospheric &Ionosphere effects on link design, Complete link design, Earth station parameters | | | | 7 |
| **INTERNAL TEST 2(Module 2)** | | | | | |
| **III** | Analog Satellite Communication : FDM techniques, S/N & C/N ratio in frequency modulation in satellite link, S/N ratio in FM with multiplexed telephone signal in satellite link, Single channel per carrier(SCPC) systems, Companded single sideband (CSSB) systems, Analog FM/FDM TV satellite link, Intermodulation products & their effects in FM/FDM systems, Energy disposal in FM/FDM systems  Digital Satellite Communication - Elements of digital satellite communication systems-, Digital modulation techniques like MSK, GMSK/, QAM ,Satellite digital link design | | | | 7 |
| **IV** | Special Purpose Communication satellites: BDS, INMARSAT, INTELSAT, VSAT (data broadband satellite), MSAT (Mobile Satellite Communication technique), Sarsat (Search & Rescue satellite) & LEOs (Lower earth orbit satellite), Satellite communication with respect to Fiber Optic Communication, LANDSAT, Defense satellite.  LASER Satellite Communication: Introduction, Link analysis, Optical satellite link transmitter, Optical satellite link receiver, Satellite Beam Acquisition, Tracking & Positioning, Deep Space Optical Communication Link | | | | 6 |
| **END SEMESTER EXAM (All Modules)** | | | | | |
| **REFERENCES:**   1. Dr.D.C. Agarwal, “Satellite Communications”,Khanna Publishers, 2001 2. Tri.T.Ha, “Digital Satellite Communications”,Tata McGraw-Hill Education-2009 3. T. Pratt and C.W. Bostian “Satellite Communications”John Wiley &Sons 2002 4. [Monojit Mitra](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22MONOJIT+MITRA%22) “Satellite Communication “PHI Learning Pvt. Ltd., 2005 5. M.Richharia, “Mobile Satellite Communications-Principles & Trends”, Pearson Education, 2003 6. William H. Mott, et al, "[Laser Satellite Communication : The 3rd Generation](http://www.amazon.com/exec/obidos/ASIN/1567203299/ref=ase_rajjainA/)," Quorum Books, January 2000 7. Roger Cochetti, "[Mobile Satellite Communications Handbook](http://www.amazon.com/exec/obidos/ASIN/047129778X/ref=ase_rajjainA/)," Wiley, June 1998. | | | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 7267** | 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. | | | |
| Each student shall present a seminar on any topic related to their mini project or thesis work of  the M. Tech. Program. The selected topic should be based on the papers published in reputed international journals preferably IEEE.They should get the paper approved by the Program Co-coordinator/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 | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 7287** | PROJECT (PHASE 1) | 0-0-12-6 | 2015 |
| In Master’s thesis Phase-I, the students are expected to select an emerging research area in Communication Engineering or related fields, after conducting a detailed literature survey. A detailed design should be prepared based on the study, comparison, analysis and review of the research work and recent developments in the area. Recent National/International Conference proceedings/Journals, preferably IEEE/ACM, should be referred for the selection of the 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. Emphasis should be given for literature survey, scope and design of the proposed work along with the details of the preliminary work carried out on the thesis topic. 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 examiners. This panel can be a committee headed by the head of the department with two other faculty members in the area of the project, of which one shall be the project supervisor .If the project is done outside the college, the external supervisor associated with the student will also be a member of the committee. The examiners should give their suggestions in writing to the students so that it should be incorporated in the Phase–II of the thesis.A report is to be submitted at the completion of the project. The project will be evaluated on the basis of (i) physical inspection of the project (ii) project report and (iii) oral examination.  Project work Phase 1 includes   1. Selection of the area of specialization. 2. Selection of the project title from the area of specialization. 3. Literature survey, analysis and simulation. 4. Division of the project to sub tasks and time plan. 5. Formulation of the expected outcomes.   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. | | | |
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| COURSE CODE | COURSE NAME | L-T-P-C | YEAR |
| **05EC 7288** | 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.   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. | | | |
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