RAMAIAH
Institute of Technology

# CURRICULUM

**for the Academic year 2019 – 2020**

## TELECOMMUNICATION ENGINEERING

**VII & VIII SEMESTER B.E**

**RAMAIAH INSTITUTE OF TECHNOLOGY**
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

## About the Institute:

Ramaiah Institute of Technology (RIT) (formerly known as M. S. Ramaiah Institute of Technology) is a self-financing institution established in Bangalore in the year 1962 by the industrialist and philanthropist, Late Dr. M S Ramaiah. The institute is accredited with "A" grade by NAAC in 2014 and all engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with prescribed faculty student ratio and achieves excellent academic results. The institute was a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments have competent faculty, with 100% of them being postgraduates or doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. All research departments are active with sponsored projects and more than 304 scholars are pursuing PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus. RIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with over 1,35,427 books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern auditorium, several hi-tech conference halls and all are air-conditioned with video conferencing facilities. It has excellent hostel facilities for boys and girls. RIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. RIT obtained Academic Autonomy for all its UG and PG programs in the year 2007. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 64$^{th}$ rank in 2019 among the top 100 engineering colleges across India.

## About the Department:

The department of Telecommunication Engineering was established in 1996 to address the increasing demand for professionals with expertise in communication and networking technology in India. The department has state of the art laboratories, equipment's, resources and committed faculty having best of the academic and industry recognition. The department started a ***M.Tech program in Digital Communication in the year 2004***. The department has a ***Research Centre*** with 15 students, which was started in the year 2012. Department has collaborations with some of the leading industries like., ***Nokia, Honeywell, Intel, ARM-Nuvoton, Ericsson, Samsung, ABB*** and with leading national and international universities like ***Stanford University, IIT-M,*** enabling the department to focus on R&D, and thus providing new avenues for PG/UG students for placement and higher studies. Department is accredited by the ***National Board of Accreditation under AICTE***. There are ***5 Funded Research projects*** (Industry and Government) ongoing in the department involving students to carry out innovative projects. The IEEE Sensor Council focuses on many IEEE student activities.

## VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio economic needs

## MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

## QUALITY POLICY

We at MS Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

## VISION OF THE DEPARTMENT

To provide highly conducive ambience for the students to achieve all round growth and excel in studies and research to become the most successful engineers

## MISSION OF THE DEPARTMENT

- Telecommunication Engineering Department endeavor upon providing high quality technical education to meet the ever growing challenges in the emerging industry and social needs.
- To provide all-round personality development with social responsibility emphasizing on quality, standards, research and innovation for students and faculty.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

**PEO1:** Graduates will excel in professional careers in Industry, Academic, Research and Development that meet the needs of Organizations.

**PEO2:** Graduates will be able to analyze real life problems and be able to suggest solutions to design complex engineering systems that are technically sound, economically feasible and socially acceptable.

**PE03:** Graduates will exhibit all-round education that includes communication skills, the ability |to function well in a team, an appreciation for ethical behavior and the ability to engage in lifelong learning.

**PROGRAM OUTCOMES (POs):**

**PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being

able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES (PSOs):**

**PSO1:** Identify, analyze, formulate, design and demonstrate applications relevant to telecommunication engineering using electronic devices**.**

**PSO2:** Use current technology and modern tools to address solutions for telecommunication products by taking into account safety healthy environmental requirements

**PSO3:** Apply project management tools to solve Telecommunication systems by exhibiting teamwork, lifelong learning

## Curriculum Course Credits Distribution
## Batch 2016-20

| Semester | Humanities & Social Sciences (HSS) | Basic Sciences / Lab (BS) | Engineering Sciences/ Lab (ES) | Professional Courses- Core (Hard core, soft core, Lab) (PC-C) | Professional Courses - Electives (PC-E) | Other Electives (OE) | Project Work (PW) | Internship/ other activities (IS/ECA) | Total semester load |
|---|---|---|---|---|---|---|---|---|---|
| **First** | **02** | **09** | **14** | | | | | | **25** |
| **Second** | **02** | **09** | **14** | | | | | | **25** |
| **Third** | | **04** | | **21** | | | | | **25** |
| **Fourth** | | **04** | | **21** | | | | | **25** |
| **Fifth** | | | | **21** | **4** | | | | **25** |
| **Sixth** | | | | **15** | **4** | | **6** | | **25** |
| **Seventh** | | | | **14** | **12** | | | | **26** |
| **Eighth** | | | | | | **4** | **18** | **2** | **24** |
| **Total** | **04** | **26** | **28** | **92** | **20** | **4** | **24** | **2** | **200** |

**SCHEME OF TEACHING**
**VII SEMESTER**

| Sl. No. | Course Code | Course Name | Category | Credits | | | | | Contact Hours |
|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | S | Total | |
| 1. | TC71 | Communication Protocols and Standards | PC_C | 4 | 0 | 0 | 0 | 4 | 4 |
| 2. | TC72 | Optical Communication | PC_C | 4 | 0 | 0 | 0 | 4 | 4 |
| 3. | TC73 | Wireless Communication Technologies | PC_C | 3 | 0 | 0 | 0 | 3 | 3 |
| 4. | TCE-- | Department Elective | PC_E | 3 | 0 | 0 | 1 | 4 | 3 |
| 5. | TCE-- | Department Elective | PC_E | 3 | 0 | 0 | 1 | 4 | 3 |
| 6. | TCE-- | Department Elective | PC_E | 4 | 0 | 0 | 0 | 4 | 4 |
| 7. | TCL74 | Communication Networks Lab | PC_C | 0 | 0 | 1 | 0 | 1 | 2 |
| 8. | TCL75 | DSP Systems Lab | PC_C | 0 | 1 | 1 | 0 | 2 | 4 |
| | | | **Total** | **21** | **1** | **2** | **2** | **26** | **27** |

**SCHEME OF TEACHING**
**VIII SEMESTER**

| Sl. No. | Course Code | Course Name | Category | Credits | | | | | Contact Hours |
|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | S | Total | |
| 1. | XXOExx | Institute elective | PC_C | 4 | 0 | 0 | 0 | 4 | 4 |
| 2. | TCIN | Internship/Departmental Elective | IN/PC_E | 0 | 0 | 4 | 0 | 4 | 8 |
| 3. | TCP | Project Work | PW | 0 | 0 | 14 | 0 | 14 | 28 |
| 4. | EAC | Extracurricular/ Co-curricular activities | EAC | 0 | 0 | 2 | 0 | 2 | 04 |
| | | | **Total** | **4** | **0** | **20** | **0** | **24** | **44** |

**List of electives**

| Semester | Group A<br>Networks and Systems | Group B<br>Embedded Systems | Group C<br>Communication and Signal Processing |
|---|---|---|---|
| 7th Semester | Wireless Mesh Networks TCE13 | Embedded Networks and Protocols TCE23 | Software Defined Radio TCE33 |
| 7th Semester | Neural Networks and Fuzzy Logic, TCE14 | Applications of Sensing and Analysis, TCE24 | Multimedia Communication TCE34 |
| 7th Semester | Network Security TCE15 | MEMS, TCE25 | DSP algorithms and applications TCE35 |
| 8th Semester | - | Automotive Electronics, TCE26 | Wavelets and Applications TCE36 |

## VII Semester

# COMMUNICATION PROTOCOLS AND STANDARDS

**Course Code: TC71** **Credit: 4:0:0:0 Course**
**coordinator: Arvind Kumar G** **Contact Hours: 56**
**Pre requisite: Digital Communication (TC61),**
**Computer Communication Networks (TC62)**

**Course Content:**

**UNIT 1**

**Fundamentals Of Cellular Systems:** Cellular component identification. Call establishment. Wireless Network Architecture and Operation: The Cell concept, Cellular advantage, Cellular Hierarchy, Cell Fundamentals, Re-use Number, Capacity expansion Techniques - Cell splitting, Cell Sectoring, over laid cells,

**UNIT 2**

**Wireless LAN:** Introduction to Wireless LAN 802.11 X Technologies. Evolution of Wireless LAN. Introduction to 802.I5X. Wireless PAN Applications and Architecture. Blue tooth WPAN Adhoc Network Topologies. IEEE 802.15.4 pi-conets. Introduction to WMAN IEEE 802.16 wireless MANs.

**UNIT 3**

**Wireless Wide Area Network:** Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC.

**UNIT 4**

**Basic Wireless Sensor Technology:** Introduction, Sensor Node Technology, Overview, Hardware and Software, Sensor Taxonomy, WN Operating Environment, WN Trends.

**UNIT 5**

**Medium Access Control Protocols for Wireless Sensor Networks:** Introduction, Background, Fundamentals of MAC Protocols, Performance Requirements, Common Protocols, MAC Protocols for WSNs.

**TEXT BOOKS:**


1. Gary J. Mullett and Thomson Delmar, “Wireless Telecommunications Systems and Networks”, Cengage Learning, 2006
2. Kazem Sohraby, Daniel Minoli, TaiebZnati, “Wireless Sensor Networks: Technology, Protocols, and Applications”, John Wiley Publication, 2007.
3. Vijay K Garg, Joseph E Wilkies, “Principles of Applications of GSM”, Pearson edition, 1999
4. Vijay K Garg, “Wireless Communication and Networking”, Morgan Kaufman, 2009

**REFERENCE BOOKS:**


1. Theodore S Rappaport, "Wireless Communications, Principles and Practice", PHI 2nd edition, 2010.
2. Waltenegus Dargie and Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley Publication, 2010.


**COURSE OUTCOMES (COs):**

1. Understand and Study cellular technology **(PO 1, 2, 3, 5) (PSO 1)**
2. Discuss the different Wireless LAN protocols. **(PO 1, 2, 3, 4, 12) (PSO 1, 3)**
3. Understand the working of UTMS architectures. **(PO 1, 2, 3, 4, 12) (PSO 1, 3)**
4. Understand the basic sensor network, their architectural elements and applications. **(PO 1, 2, 3, 4, 7, 12) (PSO 1, 3)**
5. Analyze the various MAC protocols, scheduling, synchronization and Applications of WAN/MAN. **(PO 1, 2, 4, 9, 11) (PSO 1, 3)**

# OPTICAL COMMUNICATION

**Course Code: TC72** **Credit: 4:0:0:0**
**Course Coordinator/s: Mr. S. J. Krishna Prasad** **Contact Hours: 56**
**Prerequisites: Digital Communication (TC61), Engineering Electromagnetics (TC35) and Engineering Physics. (PHY101/201)**

**Course Content:**

**UNIT 1**

**Introduction To Optical Communication:** Introduction, general system, advantages, disadvantages and applications of optical fiber communication, optical fiber waveguides, Ray theory, single mode fiber, cutoff wavelength, mode field diameter ,group velocity, phase velocity, group delay ,Fiber materials, Photonic crystals ,Optical Cables.
**Transmission Characteristics of Optical Fibers:** Attenuation, Absorption Scattering losses Inter and Intra modal dispersions.

**UNIT 2**

**Optical Sources and Detectors:** Semiconductor Theory, DH LED structures, its variants, Lasing Principles & conditions and models. Photo detectors, Device types and respective parameters.

**UNIT 3**

**Fiber Couplers and Connectors:** Fiber joints, Mechanical misalignments and end face preparations, Fiber Splicing Connectors & variants.
**Optical receivers:** Digital optical receiver performance parameters & noises, Eye diagram,

**UNIT 4**

**Analog Links:** Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, RF over fiber
**Digital links:** Digital point to point links, Link power budget & Rise time budget analysis,

**UNIT 5**

**WDM Concepts and Optical Amplifiers:** EDFA, WDM standards, SONET/SDH, SONET rings and architectures, Multiplexers, directional couplers, Isolators and circulators.

**TEXT BOOKS:**


1. Gerd Keiser, “Optical Fiber Communications”, TMGH, 5th edition, 2012
2. John M. Senior, “Optical Fiber Communications Principles and Practice”, Pearson education, Second edition, 2010

**REFERENCE BOOKS:**

1. Joseph C Palais, “Fiber Optic Communication”, 4th Edition, Pearson Education, 2011

**COURSE OUTCOMES (COs):**

1. Employ operational techniques of optical fiber to build optical communication systems**. (PO1, 2, 11) (PSO1)**
2. Illustrate design of optical sources and detectors. **(PO1, 2, 4) (PSO1)**
3. Examine design of connectors, couplers in optical networks and digital optical links. **(PO2, 4, 11) (PSO1)**
4. Get Appraised of Analog links and power penalty issues in digital links**. (PO2, 5, 11) (PSO1)**
5. Analyze Optical protocols, related architecture standards & optical devices **(PO4, 5, 11) (PSO2, 3)**

# WIRELESS COMMUNICATIONS TECHNOLOGY

**Course Code: TC73** **Credit: 3:0:0:0**
**Course Coordinator: Kusuma S M** **Contact Hours: 42**
**Prerequisites : Digital Communication (TC61)**

**Course Content:**

**UNIT 1**

**Introduction to 3G/4G Wireless communications, Channel Modelling of wireless systems:** System Model for Narrowband signals, Rayleigh fading wireless channel – BER performance of wireless systems Diversity in wireless communication, RMS Delay Spread, coherence bandwidth, coherence time, Doppler Fading, Jakes Model, Autocorrelation – Jakes Spectrum – Impact of Doppler Fading.

**UNIT 2**

**Code Division Multiple Access**: Introduction to CDMA – Basic of CDMA Mechanism, spreading codes based on Pseudo-Noise (PN) Sequences, correlation properties of Random CDMA Spreading sequences, Multiuser CDMA, Advantages of CDMA, Multipath diversity RAKE receiver, CDMA Near- CDMA Near-Far problem and power control, OVSF tree.

**UNIT 3**

**Multiple Input Multiple Output Systems:** Introduction to MIMO Wireless communications, MIMO system Model, MIMO Zero Forcing (ZF) Receiver, , Singular value Decomposition of the MIMO channel, Singular Value Decomposition and MIMO capacity, MIMO Channel – MIMO Spatial Multiplexing – Nonlinear MIMO Receiver - VBLAST —Alamouti and space –time Codes , MIMO Beam forming: MIMO Zero Forcing (ZF) Receiver

**UNIT 4**

**Orthogonal Frequency Division Multiplexing**: Introduction–Motivation and Multi carrier basics multicarrier Transmission, Cyclic prefix in OFDM, MIMO-OFDM Transmitter Schematic - OFDM issues – Peak to Average Power Ratio MIMO-OFDM Receiver Schematic

**UNIT 5**

**Ultrawide Band:** UWB Definition and Features – UWB Wireless channels – UWB Data Modulation – 3G and 4G Wireless Standards High speed Uplink Packet access (HSUPA), High speed down link packet access (HSDPA). 4G LTE architecture and, Hierarchical model of 4G networks.

**TEXT BOOK:**


1. Aditya K Jaganatham, “Principles of Modern of wireless communication systems”, McGraw Hill Education, 2016
2. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Prentice Hall, 2003.

**REFERENCE BOOKS:**


1. Theodore S Rappaport, "Wireless Communications, Principles and Practice", PHI 2nd edition, 2010
2. Andrea goldsmith, "Wireless Communications", Cambridge University press, 2007.
3. Saha Misra, "Wireless Communications and Networks: 3G and beyond", Tata Mc. Graw hill education ltd., New Delhi, 2009.
4. Sumit kasera and Nishant narang, "3G networks architecture, protocols and procedures", Tata Mcgraw hill professional series, fifth reprint, 2008.


**COURSE OUTCOMES (COs):**

Students will be able to

1. Explain and model the wireless channel with performance evaluation **PO1, 2, 3, 4, 5, 6, 7, 8, 10, 11) (PSO1, 2, 3)**
2. Discuss and analyze the CDMA mechanisms used in 3G / 4G technologies. **(PO1, 2, 3, 4, 5, 6, 7, 8, 10, 11) (PSO1, 2, 3)**
3. Illustrate the MIMO techniques and their spatial Multiplexing capabilities along with diversity techniques. **(PO1, 2, 3, 4) (PSO1,2,3)**
4. Discuss and apply the OFDM concepts and also to tackle the issues relating to power and frequency **(PO1, 2, 3, 4) (PSO1, 2, 3)**
5. Explain the Ultra wide band ( UWB), LTE and WiMAX architecture and **networks (PO1, 2, 3, 4, 5, 6, 7, 8, 10, 11) (PSO1, 2, 3)**

# COMMUNICATION NETWORKS LAB

**Course Code: TCL74** **Credit: 0: 0: 1:0**
**Course Co-coordinator: Arvind Kumar G** **Contact Hours: 28**
**Pre-requisites: Computer Communication Networks (TC62)**

**Course Content:**

**LIST OF EXPERIMENTS**

**Part A (Software Simulation using NS2/NS3)**

1. Simulation of a simple wired network
2. Simulation of wired network topologies: (a) Bus (b) Ring (c) Mesh
3. Simulation of simple wireless network (Mobile Adhoc network) scenario
4. Simulation of simple LAN using NS2
5. Simulation of Adhoc routing protocols - DSR
6. Simulation of Adhoc routing protocols - AODV
7. Simulation of DSDV routing with energy model for given wireless network

**Part B (Hardware using routers, switches, OFC Trainer Kits & Light Runner)**

1. Extract Packet Arrival Time, Source IP Address, Destination IP Address and Port., Protocol analysis.
2. Extract Source MAC Address and Destination MAC Address
3. Get Inter-Arrival Time While Capturing Packets.
4. Set up a wireless communication between two wireless routers and find the latency, bandwidth and throughput
5. Study of Analog and Digital Fiber Optic Links
6. Bit error rate and Eye Pattern analysis of Digital Optical links.
7. Study of WDM Fiber Optic Link.

**TEXT BOOKS:**


1. Jha Rakesh Kumar and Kharga Pooja, "A Journey starts from Basic Understanding of NS2 to NS3", LAMBERT, 2015
2. B Forouzan, "Data communication and networking", 4$^{th}$edition, TMH, 2009.
3. William Stallings, "Data and Computer Communication", PHI, 2012.
4. Gerd Keiser "Optical Fiber Communications", TMGrH, 4$^{th}$ edition, 2010 reprint

**COURSE OUTCOMES (COs):**

Students will be able to

1. Implement a Wired/Wireless LAN Network **(PO 1, 2, 3, 4, 5, 8, 9, 10,11,12) (PSO 1,2, 3)**
2. Demonstrate different network Topologies and determining the throughput delay, latency of the network. **(PO 1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
3. Configure the wireless router. **(PO 1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
4. Determining of Static/ Dynamic IP, Change of Static to dynamic IP and vice-versa **(PO 1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
5. Understand the Functioning of an Optical Fiber. **(PO 1, 2, 3, 4, 5, 8,9,10,11,12) (PSO 1, 2, 3)**

## DSP SYSTEMS LAB

**Course Code: TCL75** **Credit: 0: 1:1:0**
**Course Co-coordinator: Ramya H R** **Contact Hours: 28+28**
**Pre-requisites: DSP Lab (TCL56), DSP (TC51)**

**Course Content:**

**TUTORIALS**

1. Introduction to TMS320C6748 Processor,.TMS320C6748 DSP Block Diagram,
2. Introduction to Linear and circular Convolution, 8Point FFT (DIF), DFT and IDFT
3. Device Overview: Features, Description Functional Block Diagram, TMS320C6748 Mega module,
4. Introduction to Interpolation, Decimation Filters, FIR and IIR Filter implementation
2. Introduction to adaptive filters Adaptive structures, Algorithms and implementation
3. Internal Memory Controllers, Internal Peripherals, Interrupt Controller (INTC), MAC operation using various addressing modes
4. Power-Down Controller (PDC), Bandwidth Manager (BWM),
5. Functional units, Fetch and execute packets
6. Introduction to Audio Processing with Audio loop back. Delayed Audio Loop Back, Echoed Audio
7. Waveform generation using Audio CODEC and Storing Audio Signals in External Memory
8. Introduction to image processing and its operations
9. Introduction to Image Capturing and processing using USB Camber using cross compiler
10. Video Capturing and displaying in VGA monitor using cross compiler

**LAB EXPERIMENTS**

Experiments using OMAPl138 (6748 LCDK) DSP (TMS320C6748):

**Part A**

**Non-Real Time Experiments With C6748 DSK:**

1. Solution Of Differential Equations, Generation of random signal and sine wave and to compute and plot Power Density Spectrum
2. To Verify Linear and circular Convolution
3. To find 8Point FFT (DIF), DFT and IDFT of Given Samples
4. Interpolation and Decimation Filters
5. FIR and IIR Filter implementation
6. Adaptive Filter implementation
7. MAC operation using various addressing modes (assembly programming).

**Part B**

Real Time Experiments with C6748 DSK using Audio CODEC: Audio Processing, IMAGE PROCESSING and ARM (ARM926EJ-S) Using Cross Compiler

8. Audio Processing with Audio loop back. Delayed Audio Loop Back, Echoed Audio
9. Waveform generation using Audio CODEC and Storing Audio Signals in External Memory
10. Applying DCT/IDCT on image
11. Pixel operations on images
12. Applying Filters to Image, Smoothing, Sharpening, Threshold and Sobel edge
13. Demo on Image Capturing and processing using USB Camber
14. Demo on Video Capturing and displaying in VGA monitor

**TEXT BOOKS:**


1. Donald Reay, **"**Digital Signal Processing and Applications with the OMAP - L138", March 2012
2. Thad B. Welch, Cameron H.G. Wright and Michael G. Morrow, "Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs", Third Edition, Jan 2017
3. Alan V. Oppenheim and Ronald W. Schafer, "Discrete-Time Signal Processing", 3rd edition (2011) by "TMS320C6748 DSP" Technical Reference Manual, September 2016


**COURSE OUTCOMES (COs):**

1. Implement Non-Real Time Experiments with C6748 DSK like DIF, DFT etc **(PO 1, 2, 3, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
2. Understand FIR, IIR, Adaptive filter implementation **(PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
3. Implement the Real Time Experiments With C6748 DSK using Audio CODEC **(PO 1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
4. Configure the of image processing operations with C6748 DSK **(PO 1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1,2,3)**
5. Demonstrate the concept of Image and video Capturing and processing using USB Camber and VGA monitor **(PO 1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**

## VIII Semester

### OPEN ELECTIVE OFFERED TO OTHER DEPARTMENTS
### COMMUNICATION SYSTEM AND NETWORKS

**Course Code: TCOE01** **Credit: 4:0:0:0**
**Course Coordinator: Arvind Kumar G** **Contact Hours: 56**
**Prerequisites: Basic Electronics(EC 15/25)**

**Course Content:**

**UNIT 1**

**Introduction to Communication Systems:** Introduction to Communication Systems, Elements of a communication system, Modulation and its necessity, Types of Modulation, Binary Data Transmission, Multiplexing techniques.

**UNIT 2**

**Introduction to Computer Networks:** Data Communication, Networks, Protocols and Standards, Topology, Categories of Networks, OSI & TCP/IP Protocol suites

**UNIT 3**

**Optical Fiber Communication:** Motivation for optical communications, advantages of optical fibers key elements of optical fiber communication link. Total Internal Reflection, fiber types, Attenuation in fibers

**UNIT 4**

**Wireless Communication:** An Overview of Wireless System, First- and Second-Generation Cellular Systems, Wireless Network Architecture and Operation: The Cell concept, Cellular advantage, Cellular Hierarchy, Cell Fundamentals, Re-use Number, Capacity expansion Techniques - Cell splitting, Cell Sectoring

**UNIT 5**

**Wireless Sensor Networks and its Applications:** Background and Application of Sensor Network, Basic sensor network Architectural Elements. Application of Wireless Sensor Networks: Range of application, Examples of category II WSN application, Examples of category I WSN applications.

**TEXT BOOKS**


1. Simon Haykins, "An Introduction to analog and Digital communications", John Wiley, 2010
2. Andrew S. Tanembaum, "Computer Networks", 4th edition, Pearson Education, 2003.
3. Gerd Keiser, "Optical Fiber Communications", TMGrH, 4th edition, 2010 reprint
4. Gary J. Mullett and Thomson Delmar, "Wireless Telecommunications Systems and Networks", Learning, 2006
5. Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John Wiley Publication, 2007.

**COURSE OUTCOMES (COs):**

1. Describe optical networks and to Design various optical components**. (PO 1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1,3)**
2. Understand the different networks, its topologies, and components**. (PO 1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1,3)**
3. Employ operational techniques of optical fiber to build optical Communication Systems. **(PO1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 3)**
4. Procure the idea of wireless communication, and Study cellular technology**. (PO 1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 3)**
5. Understanding the basics of Sensor Networks and its applications**. (PO 1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 3)**

# AUTOMOTIVE ELECTRONICS

**Course Code: TCE26** **Credit: 3:0:0:1**
**Course Coordinator/s: Dr. S. G. Shivaprasad Yadav** **Contact Hours: 42**
**Basic Electronics (EC101), Microcontrollers (TC42), Embedded System Design (TC63)**

**Course Content:**

**UNIT-1**

**Automotive Fundamentals Overview:** Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Battery.
**Self-study component:** Steering and Starting System.

**UNIT-2**

**Electronics Fundamentals:** Semiconductor Devices, Operational Amplifiers, Analog Computers, Digital Circuits, Logic Circuits (Combinational and Sequential), Integrated Circuits, Microprocessor.
**Self-study component:** Application case studies using microcontrollers

**UNIT-3**

**Electronic Engine Control:** Motivation for Electronic Engine **Control**, Concept of an Electronic Engine Control Engine parameters, variables, Engine Performance terms.
**Self-study component:** Electronic Fuel Control System.

**UNIT-4**

**Sensors**: Oxygen (O2/EGO) Sensors, Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor - Strain gauge and Capacitor capsule, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rate sensor, Throttle angle sensor Actuators – Fuel Metering Actuator
**Self-study component:** Fuel Injector, Ignition Actuator and EGR Actuator

**UNIT-5**

**Vehicle Motion Control**: Electronic suspension system, Antilock Brake System (ABS), Electronic Steering Control Future Automotive Electronic Systems – Alternative Fuel Engines, Electrical and Hybrid vehicles. Collision Avoidance Radar warning Systems, Low tire pressure warning system
**Self-study component:** Radio navigation, Advanced Driver Information System

**TEXT BOOKS:**

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing, 2013.

**REFERENCE BOOKS**


1. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 2001
2. James D Halderman, "Automotive Electricity and Electronics", PHI Publication, 2012
3. Terence Rybak and Mark Stefika, "Automotive Electromagnetic Compatibility (EMC)", Springer, 2014
4. Allan Bonnick, "Automotive Computer Controlled Systems - Diagnostic Tools and Techniques", Elsevier Science, 2010
5. Uwe Kieneke and Lars Nielsen, "Automotive Control Systems Engine, Driveline and Vehicle", 2nd Edition, Springer, Verlag, 2008


**COURSE OUTCOMES (COs):**

1. Apply the knowledge of engineering and science to analyze the performance of Electronic Engine Control, working of sensors and actuators **(PO1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 2,3)**
2. Analyze the vehicle level Electronic Control for automotive subsystems. **(PO1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 2, 3)**
3. Understand and make choices of hardware and software in the design and implementation of a high-end Electronic Control Unit for automotive applications **(PO1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 3)**
4. Understand various communication systems and protocols used in networking for automotive applications **(PO1, 2, 3, 4, 5, 9, 10, 11, 12) (PSO 1, 3)**
5. Gain insight about building future automotive subsystems that contributes to the safety and health of the society using block diagram approach **(PO1, 2, 3, 4, 5, 9,10,11,12) (PSO 1,2,3)**

# WAVELETS AND APPLICATIONS

**Course Code: TCE36** **Credit : 3:0:0:1**
**Course Coordinator: Dr. Parimala. P** **Contact Hours: 42**
**Prerequisite: Digital Signal Processing (TC51)**

**Course Content:**

**UNIT 1**

**Introduction:** Continuous wavelet transforms, Properties, Inverse transform, Examples of mother wavelets, Analytic wavelet transform.
**Self-Study:** Implementation of mother wavelets using Mat software.

**UNIT 2**

**Introduction to Discrete Wavelet Transform:** MRA, A wavelet basis for MRA, Digital filtering interpretation, Examples of orthogonal basis –generating wavelets, interpreting orthonormal MRAs for discrete time signals.
**Self-Study:** Implementation of feature extraction.

**UNIT 3**

**Bi-orthogonal Wavelets:** Bi-orthogonal wavelet bases, Filtering relationship for bi-orthogonal filters, Examples of bi-orthogonal scaling functions and wavelets, two dimensional wavelets, Multidimensional wavelets and wavelet packets.
**Self-Study:** Implementation of classification of data using wavelets.

**UNIT 4**

**Wavelet transform and data compression:** Transform coding, DTWT for image compression, Audio compression and video coding 61
**Self-Study**: Implementation of Image compression using wavelet transforms.

**UNIT 5**

**Applications of Wavelet Transforms**: De-noising, Biomedical applications, Applications in communication system, Edge detection and object isolation, Image fusion.
**Self-Study:** Application of wavelets in bio-medical signals.

**TEXT BOOKS**


1. Raghuveer M. Rao, Ajit S. Bopardikar, “Wavelet Transforms: Introduction to Theory & Applications”, Pearson Education Asia, New Delhi, 2003
2. Agostino Abbate, Casimer M. DeCusatis and Pankaj K. Das, “Wavelets and Subbands Fundamentals and Applications”, Pearson Education Asia, New Delhi, 2008

**REFERENCE BOOKS**


1. K. P. Soman and K.L. Ramchandran, "Insight into Wavelets from theory to practice", Eastern Economy Edition, 2008
2. Stephane G. Mallat, "A Wavelet Tour of Signal Processing", Academic Press, Second Edition, 1999.


**COURSE OUTCOMES (COs):**

1. Describe scaling functions, continuous wavelet transforms and different wavelet functions. **(PO 1, 2, 3, 4, 5,10,12) (PSO 1, 2)**
2. Differentiate continuous wavelet and discrete wavelet transforms and analyze multi-resolution analysis**. (PO 1, 2, 3, 4, 5, 10, 12) (PSO 1, 2)**
3. Develop bi-orthogonal wavelet basis function and apply to two dimensional signals. **(PO 1, 2, 3, 4, 5, 10, 12) (PSO 1, 2)**
4. Apply wavelet transform for image and audio compression. **(PO 1, 2, 3, 4, 5, 10, 12) (PSO 1, 2)**
5. Employ wavelet transforms for de-noising, speckle removal, object detection and data communication **(PO 1, 2, 3, 4, 5, 10, 12) (PSO 1, 2, 3)**

## INTERNSHIP

**Course Code: TCIN**
**Credit: 0: 0: 4: 0** **Contact Hours: 56**

**Course Content:**

The evaluation of students will be based on an intermediate presentation, along with written report containing a Certificate from the employer. The rubrics for evaluation of the presentation and the questionnaire for the report will be distributed at the beginning of the internship.

| Course Code | Course Name | No. of Hrs./Week | | Duration of Exam (Hrs.) | Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical/Field Work | | IA | Exam | | |
| TCIN | Internship | - | - | - | 100 | - | 100 | 4 |

**Course Outcomes (COs):**

1. Develop fundamental knowledge on the emerging technologies appropriate to telecommunication engineering (**POs 1, 2, 3, 4, 6, 7, 11, 12) (PSO 1, 2, 3)**
2. Demonstrate expertise in identifying and solving the problems specific to communication domain. **(POs 1, 2, 3, 4, 6, 7, 8, 11, 12) (PSO 1, 2, 3)**
3. Gain exposure to industry/organization work culture and practices with focus on modern tools/techniques used in the industry and understand the limitations of the use of current technology. **(POs 1, 2, 3, 5, 6, 7) (PSO 1, 2)**
4. Demonstrate effective management of personal behavior, ethics and time management towards achieving the internship goal contributing as an individual/ team member in multidisciplinary environments. **(POs 8, 9, 10, 11) (PSO 3)**
5. Demonstrate effective presentation & communication skills, time management and create proper documentation of the work. **(POs 7, 9, 10, 11, 12) (PSO 2, 3)**

## PROJECT WORK

**Course Code: TCP**
**Credit: 0 :0: 14: 0**

**Course Content:**

Students will complete the technical project work under the guidance of the faculty member in the department. The quality of the work will be judged in three presentations, where the panel consists of the guide and other faculty members in the project domain.

| Subject code | Subject | No. of Hrs./Week | | Duration of exam | Marks | | Total marks | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical/ Field work | | IA | Exam | | |
| TCP | PROJECT WORK | - | 14 | - | 50 | 50 | 100 | 14 |

**Course Outcomes (COs):**

1. Review the literature and identify a suitable problem by analyzing the requirements based on current trends and societal needs in the domain of interest and arrive at the specifications. **(POs 1, 2, 4, 6, 7, 9, 12) (PSO 1, 2, 3)**
2. Identify the methodology for implementing the project by visualizing the Hardware and Software. **(POs 1, 2, 3, 4, 7, 11) (PSO 1, 2, 3)**
3. Design and Implementation of identified Problem using appropriate tools and Techniques in the area of telecommunication/ multidisciplinary areas. **(POs 1, 2, 3, 4, 5, 6, 7, 9) (PSO 1, 2, 3)**
4. Validate the achieved results and demonstrate good project defense, presentation skills, leadership and punctuality as a team/individual. **(POs 8, 9, 10, 11) (PSO 3)**
5. Ability to write the thesis following ethical values and attempt to publish the work in quality conferences/journals supporting lifelong learning abilities. **(POs 8, 9, 10, 12) (PSO 3)**

## EXTRA CURRICULAR/ CO-CURRICULAR ACTIVITIES (EAC)

**Course Code: EAC**
**Credit: 0 :0: 2: 0**

### Details for Extra-Curricular and Co-Curricular Activities

In the Uniform Teaching Scheme for UG from 2015-16 batch, two credits are allocated to Extra-Curricular and Co-Curricular Activities (EAC). The student is made aware of the credits allotted to EAC at the beginning of the First semester by the respective Department Coordinator /Proctor.

The evaluation procedure is as follows:

- Each student needs to submit the evidence for the claims for the relevant categories mentioned in the table for evaluation
- If any student has a significant contribution in any category other than the above-mentioned need to submit the report with proof
- The evaluation is done when the student is in 8th semester
- The evaluation rubrics must be made known to the students
- The department must clearly specify/justify the rubrics for evaluation
- The evaluation team involves Proctor/HOD/Committee (faculty nominated by HOD)

| Course Code | Course Name | No. of Hrs/Week | | Duration of Exam (Hrs.) | Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| | | Lecture | Practical/Field Work | | IA | Exam | | |
| EAC | Extra-Curricular and Co-Curricular Activities | - | - | - | 100 | - | 100 | 2 |

**COURSE OUTCOMES (COs):**

1. Demonstrate their talents and gain confidence to participate in extracurricular activities in future **(PO 6, 7, 9, 10, 12) (PSO 2, 3)**
2. Improve their self-thinking, self- understanding to promote their individual growth and balance between academics and outside commitments **(PO 6, 8, 9, 12) (PSO 2, 3)**
3. Demonstrate enhanced communication and public speaking skills, organizational skills, leadership skills and work in multidisciplinary teams with positive attitude **(PO 6, 7, 9, 10, 11, 12) (PSO 2, 3)**