RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2020 – 2021

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

VII & VIII SEMESTER B.E

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

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 13 UG programs and 15 PG programs. All these programs are approved by AICTE. All the UG programs & 09 PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A' grade by NAAC in 2014. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs till the year 2029. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 60% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility to all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology & Schneider Centre of Excellence. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 65 & world ranking 578 for the year 2020.**

The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology secured All India Rank 8th for the year 2020 for Atal Ranking of Institutions on Innovation Achievements (ARIIA), an initiative of Ministry of Human Resource Development (MHRD), Govt. of India.** MSRIT 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 good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. It has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. **As per the National Institutional Ranking Framework, MHRD, Government of India, M S Ramaiah Institute of Technology has achieved 59th rank among 1071 top Engineering institutions of India for the year 2020 and 1st rank amongst Engineering colleges (VTU) in Karnataka.**

About the Department:

The Department of Electronics &Telecommunication Engineering (Formerly known as 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 also started a **Research Centre** in the year 2012 and currently has 12 Research Scholars carrying out their Research. Department has collaborations with some of the leading industries like **Texas Instruments, Ansys, Rohde & Schwarz, JV Micronics, Nokia, Honeywell, Intel, ARM-Nuvoton, Ericsson, Samsung, ABB** and with leading national and international universities like **Bradley University, 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. Both UG and PG Programs are accredited by the **National Board of Accreditation**. There are **5 Funded Research projects** (Industry and Government) ongoing in the department involving students to carry out innovative projects. Many professional activities are organized regularly to the students under various professional societies like IEEE Sensor Council, IEEE Communication Society and IETE Bangalore.

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

RIT 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 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 an ambience for the students to excel in studies, research and innovation, focusing on meeting global socio-economic needs from a Telecommunication Engineering perspective

MISSION OF THE DEPARTMENT

- Providing high quality technical education to create world class Telecommunication engineers.
- Creating an ambience for skill development, research and entrepreneurial activities to meet socio-economic needs

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 and environmental requirements.

PSO3: Apply project management tools to solve Telecommunication systems by exhibiting teamwork and lifelong learning.

Curriculum Course Credits Distribution Batch 2017-21

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**	**14**	**6**	**24**
Total	**04**	**26**	**28**	**92**	**20**	**4**	**20**	**6**	**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**

List of Electives

Wireless Mesh Networks- TCE13	Embedded Networks and Protocols- TCE23	Software Defined Radio- TCE33
Neural Networks and Fuzzy Logic, TCE14	Applications of Sensing and Analysis, TCE24	Multimedia Communication - TCE34
Network Security TCE15	MEMS, TCE25	DSP Algorithms and Applications – TCE35

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

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) (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, 2, 3)**
5. Analyse 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. Discussions on Wi/Fi generations optical networks relevance in Wi/Fi networks.

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, ,3, 6,7,10, 11) (PSO1,2,3)**
2. Illustrate design of optical sources and detectors. **(PO1, 2, 4,6,11,12) (PSO1,2,3)**
3. 3Examine design of connectors, couplers in optical networks and digital optical links**. (PO1, 2, 4, 5,7,9,11,12) (PSO1,2,3)**
4. Get Appraised of Analog links and power penalty issues in digital links. **(PO2, 5, 7,9,11,12) (PSO1,2,3)**
5. Analyze Optical protocols, related architecture standards & optical devices **(PO1,4, 5,7,9,10, 11,12) (PSO1,2, 3)**

WIRELESS COMMUNICATION TECHNOLOGIES

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 BOOKS:

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)**
4. Discuss and apply the OFDM concepts and also to tackle the issues relating to power and frequency **(PO1, 2, 3, 4) (PSO1)**
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", 4th edition, TMH, 2009.
3. William Stallings, "Data and Computer Communication", PHI, 2012.
4. Gerd Keiser "Optical Fiber Communications", TMGrH, 4th edition, 2010 reprint

COURSE OUTCOMES (COs):

1. To 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

1. Audio Processing with Audio loop back. Delayed Audio Loop Back, Echoed Audio
2. Waveform generation using Audio CODEC and Storing Audio Signals in External Memory
3. Applying DCT/IDCT on image
4. Pixel operations on images
5. Applying Filters to Image, Smoothing, Sharpening, Threshold and Sobel edge
6. Demo on Image Capturing and processing using USB Camber
7. 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)**

ELECTIVE SYLLABUS

GROUP A: NETWORKS AND SYSTEMS

WIRELESS MESH NETWORKS

Course Code: TCE13 **Credit: 3:0:0:1**
Course Coordinator: Venu K N **Contact Hours: 42**
Prerequisites: Computer Communication Networks (TC62)

Course Content

UNIT 1

Fundamentals of Mesh Networks: The role of mesh in future networks, working, Physical layer, Medium access control Routing, Transport, and applications

UNIT 2

Mesh Susceptibility and mesh quality of service: Interference types, Susceptibility to interference-PHY and MAC, dedicated mesh routing and transport approaches, coexistence approaches, summary to susceptibility and coexistence approaches, quality of service levels required, and quality of service summary

UNIT 3

Mesh pit falls to avoid and routing in wireless mesh network: Summary of pitfalls to avoid, introduction to routing in wireless mesh networks, special properties of wireless mesh networks, general concepts of routing protocols, routing metrics, routing protocols, joint routing and channel assignment

UNIT 4

Implementations of Mesh Networks and security in wireless mesh: User side mesh applications, Network side or backhaul mesh applications, Joint user and network side mesh applications, Wireless cities, Community Internet, Vehicular ad hoc network. Security technology overview, mesh usage scenarios, mesh security issues

UNIT 5

Wireless sensor networks as Mesh networks and load balancing in wireless mesh networks: WSN sensors, WSN power sources, Wireless sensor technologies and applications, Differentiating RFID, mesh and sensor networks, Differentiating 802.15.x, ZigBee and 6LoWPAN, taxonomy of WSNs: structure System architecture in sensor networks, Unstructured WSNs, Structured WSNs, External routing and transport options, introduction to load balancing, gateway Gate way load balancing in wireless mesh networks, Center loading in wireless mesh networks

Self-Study Topics:

1. Mesh overview and terminology
2. Key mesh issues
3. Fundamentals of mesh topology, overview
4. Could customers self-generate capacity in a mesh?
5. Improving quality of service by adding network infrastructure
6. Cellular multihop or WLAN hotspot extension
7. Wireless cities
8. WSN system requirements
9. Classic IP- address based routing and transport
10. WSN approaches –other routing mechanisms
11. New routing metric for multi radio wireless mesh networks
12. Performance issues and their causes in WMN
13. Practical mesh networking issues
14. Antenna steering

TEXT BOOKS:

1. Steve Methley, "Essentials of Wireless Mesh Networking", Cambridge University Press, First published in 2009, ISBN 978-0-521-87680-3
2. Yan Zhang, Jijun Luo and Honglin Hu "Wireless Mesh Networking, architecture, protocols and standards", Aurebach Publications

REFERENCE BOOKS:

1. Nobuo Funabiki, "Wireless Mesh Networks", Publisher: InTech, ISBN 978-953-307-519-8, January 14, 2011.
2. Yan Zhang, Jijun Luo, and Honglin Hu, "Wireless Mesh Networking Architectures, Protocols and Standards", Auerbach Publications, ISBN 10: 0-8493-7399-9, 2007.

COURSE OUTCOMES (COs):

1. Understand the basics of wireless mesh networks **(PO1,2,3,4,5,8,9,10,11,12) (PSO01,3)**
2. Analyze the performance of wireless mesh networks at different layers of networks **(PO1,2,3,4,5,11,12) (PSO1,3)**
3. Apply quality of service in mesh networks **(PO1,2,3,4,7,9,10,11,12) (PSO1,3)**
4. Develop applications using Mesh networks **(PO1,2,3,4,11,12) (PSO1,3)**
5. Appreciate the usage of mesh networks in wireless sensor network **(PO1,2,3,4,5,8,9,10,11,12) (PSO1,2,3)**

NEURAL NETWORKS AND FUZZY LOGIC

Course Code: TCE14 **Credit: 3: 0: 0: 1**
Course coordinator: H R Ramya **Contact Hours: 42**
Prerequisites: Engineering Mathematics III (TC31), Engineering Mathematics IV (TC41)

Course Content

UNIT 1

Introduction: Basic building blocks of ANN, ANN terminologies, comparison between Artificial & Biological neural networks, Learning Rules, Network Architectures, Fundamental Models of ANN, Neural Net for Pattern Classification- Hebb Net, Perceptron, Adaline Network, Madaline Networks examples, Back propagation network- Architecture, training algorithm.
Self-Study Topic: Adaptive linear neuron Multilayer Perceptron Model

UNIT 2

Feed Forward and Feedback Networks: Discrete Hopfield network –architecture, training algorithm and energy analysis, Radial Basis Function network -Architecture, training algorithm. Associative neural network- Hetero associative neural net architecture and Auto associative net architecture, Learning vector quantizer-Architecture, training algorithm, Brain state networks- training algorithm, Boltzmann machines- training algorithm, Support Vector Machines- training algorithm.
Self-Study Topic: Unsupervised learning networks: Kohonen self-organizing feature maps, LVQ – CP networks, ART network.

UNIT 3

Fuzzy Set Theory: Fuzzy vs crisp sets, crisp sets, Operations on crisp sets, properties of crisp sets, partition and covering. Membership function, Basic fuzzy set operations, properties of Fuzzy sets, Crisp relations and Fuzzy relations.
Self-Study Topic: Fuzzy Inference Systems - Mamdani Fuzzy Models - Sugeno Fuzzy Models - Tsukamoto Fuzzy Models - Input Space Partitioning and Fuzzy Modeling.

UNIT 4

Fuzzy systems: Crisp logic: Laws of propositional logic, inference in propositional logic. Predicate logic: Interpretations of predicate logic formula, inference in predicate logic. Fuzzy logic: Fuzzy Quantifiers, Fuzzy inference. Fuzzy rule based system, Defuzzification. Applications: Greg Viot's Fuzzy cruise controller, Air conditioner controller.
Self-Study Topic: Advances in GA and its applications, Differences & similarities between GA & other traditional method

UNIT 5

Applications: Pattern classification using Hebb net and McCulloch-Pitts net, Pattern recognition using Perceptron Networks, Process identification, control, fault diagnosis and load forecasting, Implementation of all fuzzy operations on both discrete and continuous fuzzy sets, Defuzzification, Fuzzy inference system.
Self-Study Topic: Soft computing based hybrid fuzzy controllers

TEXT BOOKS

1. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic and Genetic algorithms", PHI, 2011.
2. Timothy Ross, "Fuzzy Logic with Engineering Applications", John Wiley and Sons, 2010.
3. S. N. Sivanandam, S. Sumathi and S N Deepa, "Introduction to Soft computing using Matlab 6.0", Tata McGraw Hill, 2016.

REFERENCES

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House.
2. Laurene Fausett, "Fundamentals of Neural Networks, Architectures, Algorithms, and Applications", Pearson Education, 2004
3. B. Kosko, "Neural Networks and Fuzzy systems", Prentice Hall, 1992.

COURSE OUTCOMES (COs):

1. Generate logic functions like AND, OR, XOR using learning rules. **(PO 1, 6, 12) (PSO 1, 2, 3)**
2. Apply Hebb rule and perceptron learning rule for pattern classification problem**. (PO1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12) (PSO 1, 2, 3)**
3. Understand character recognition and data compression using back propagation Network. **(PO1, 2, 3, 5, 6, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
4. Apply the rules of fuzzy logic for fuzzy controller. **((PO1, 2, 3, 5, 6, 8, 9, 10, 11, 12) (PSO1, 2, 3)**
5. Apply fuzzy set operations and defuzzification for control system applications. **(PO1, 2, 3, 5, 6, 8, 9, 10, 11, 12) (PSO1, 2, 3)**

NETWORK SECURITY

Course Code: TCE15 **Credit: 4: 0: 0: 0**
Course coordinator: Arvind Kumar G **Contact Hours: 56**
Prerequisites: Computer Communication Networks (TC62)

Course Content

UNIT 1

Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, traditional block cipher structure, the data encryption standard (DES). A DES example, the strength of DES, AES structure, AES transformation function

UNIT 2

Block Cipher operation: block cipher design principles, multiple encryption and triple DES, Electronic Code Book (ECB), Cipher block chaining mode (CBC), Cipher feedback mode (CFM)

UNIT 3

Public key cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic

UNIT 4

Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC's, Problems.
Digital Signature and Authentication Protocol: Digital signature, Authentication protocols

UNIT 5

Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64conversion, PGP random number generator.
IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security payload), Security associations, Key management, Problems).

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security", Pearson Education, 6th edition, 2014

REFERENCE BOOKS

1. Behrouz A. Forouzan, "Cryptography and Network Security", TMH, 2014
2. Atul Kahate, "Cryptography and Network security", TMH, 2014

COURSE OUTCOMES (COs):

1. Analyze the basic concepts of network security to predict and classify attacks on a network **(PO1, 2, 3, 7) (PSO 1, 2)**
2. Illustrate the process for hiding the information with cryptographic algorithms **(PO1, 2, 3, 8, 9, 10) (PSO 1, 3)**
3. Understand different key management distribution mechanisms **(PO1, 2, 3, 4, 7) (PSO 1, 2)**
4. Analyze security issues in IP and wireless networks **(PO1, 2, 3, 4) (PSO1)**
5. Analyze the mechanisms of implementing user authentication and intruder detection **(PO1, 2, 4, 5, 6, 7) (PSO 1, 2)**

GROUP B: EMBEDDED SYSTEMS

EMBEDDED NETWORKS AND PROTOCOLS

Course Code: TCE23 **Credit: 3: 0: 0: 1**
Course Coordinator: Dr. S.G. Shivaprasad Yadav **Contact Hours: 42**
Prerequisite Courses: Microcontrollers (TC42), Embedded System Design (TC63)

Course Content

UNIT 1

CAN bus: Concept of bus access and arbitration, Error Processing and Management, Increase your word power, Patents, License and certification.
CAN PROTOCOL: ISO 11898-1 Errors: Their intrinsic properties, detection and processing, the rest of the Frame-CAN 2.OB.
Self-study component: Historical context of CAN and applications

UNIT 2

CAN Physical Layer: Introduction, CAN bit, Nominal Bit Time-CAN and Signal Propagation-Bit Synchronization, Network Speed.
Medium, Implementation and Physical Layers of CAN: The range of media and types of coupling to the network, high speed CAN, optical Media, Electro Magnetic Media.
Self-study component: Pollution and EMC Conformity of CAN

UNIT 3

Components, Applications and Tools for CAN: CAN Components, application, application layer and development tools for CAN.
Flex Ray: Some general remarks, event triggered and time triggered aspects, TT CAN-towards high speed, X-by- wire and redundant systems-Flex Ray.
Self-study component: Historical context and Applications of Flexray

UNIT 4

LIN: Introduction, Basic concept of LIN 2.0 Protocol, Cost and Market, Conformity of LIN, examples.
Fail –Safe SBC- Gateways: The Strategy and principles of Re-use, Demo board gateways managing the application layers.
Safe by Wire: Safe –by-wire plus-Some Words of Technology.
Self-Study Component: History–Safe –by-wire plus

UNIT 5

Audio –Video Buses: I2C Bus, D2B (Domestic digital) BUS, MOST (Media oriented systems transport) bus-IEEE BUS OR 'Firewire'.

RF Communication: Radio –frequency communication, Internal Radio-frequency communication, External –Wireless Networks
Self-study component: Historical context and Applications of RF communication

TEXTBOOKS

1. Dominique Paret, "Multiplexed Networks for Embedded Systems-CAN, LIN, Flexray, Safe-by-Wire", John Wiley & Sons Ltd, Paris, 2009
2. Jan Axelson, "Embedded Ethernet and Internet Complete", Penram publications, Madison, 2008

REFERENCE BOOKS

1. Glaf P. Feiffer, Andrew Ayre and Christian Keyold, "Embedded networking with CAN and CAN open", Embedded System Academy, California, 2008
2. Gregory J. Pottie and William J.Kaiser, "Principles of Embedded Networked Systems Design", 2nd edition, Cambridge University press, NewYork, 2009

COURSE OUTCOMES (COs):

1. Understand the need of network protocols, its applications, CAN bus features and CAN protocol to meet the emerging application requirements **(PO1, 2, 3, 4, 9, 10, 11, 12) (PSO 1, 3)**
2. Analyze the various implementation and physical layer details of CAN protocol **(PO1, 2, 3, 4, 12) (PSO 1, 3)**
3. Analyze the various components, Application and tools for CAN and Flexray protocol **(PO1, 2, 3, 4, 12) (PSO 1, 3)**
4. Analyze the general principles of LIN protocol, Fail-Safe SBC gateways and Safe by wire protocol **(PO1, 2, 3, 12) (PSO 1, 3)**
5. Analyze the features and operations of common audio - video buses and RF communication **(PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**

APPLICATIONS OF SENSING AND ANALYSIS

Course Code: TCE24 **Credit: 3: 0: 0: 1**
Course Coordinator: Dr. Viswanath Talasila **Contact Hours: 42**
Pre-requisites: Systems Modeling and Control (TC44)
Digital Signal Processing (TC51)

Course Content

UNIT - 1

Systems and Modeling in the Biomechanics of Human Movement: Biomechanics of movement – in sports and medicine, Brief mechanics of the musculo skeleton (specific example of the upper limb) and simple (state space) mathematical models, Measurement of Movement using inertial sensors

UNIT-2

Algebra and Signal Processing in Music: Introduction to the mathematics of music – from basic algebra to Fourier series; Pingala's Recursive Combinatorial Sequence Generation, the Hemachandra-Fibonacci poetic meters and the first Error-Correcting Codes, Capture of finger movement and mapping to musical notes

UNIT-3

Embedded Systems Design for measurement of movement and music: Development of a complete embedded system to measure a complete gait cycle, choice of processors/ microcontrollers, selection of sampling rates, Choice and placement of sensors, Architecture of the embedded system, Embedded programming to measure movement (in gait and while playing music), For inertial sensing and For image processing

UNIT-4

Communication of Movement: Body Area Networks: Basic Theory of Body Area Networks (IEEE 802.15.6), Communication Bands in BAN, Antenna Systems for BAN, Interoperability and Security Issues

UNIT-5

System Integration: Hardware Integration, Software Integration, Interface testing, System testing, Stress testing, High level architecture of system integration

Self-Study Component:
Students will be expected to present a report by setting up a detailed state space model capturing specific dynamical behavior in the movement of the upper limb; an FFT technique used in music signal processing, an embedded systems architecture to capture movement and a report on BAN using BLE communication.

1. Camera based systems to measure the gait of a person; specifically focusing on the specifications of the cameras (Unit-1)
2. Force platform systems used to measure the forces applied (by the feet) during a gait. The focus should be on the 3D aspects of force measurement (Unit-2)
3. Use of inertial sensors in embedded systems for gait measurements. (Unit- 3)
4. Use of BLE in Body Area Networks (Unit- 4)

TEXT BOOKS

1. Duane Knudson, Fundamentals of Biomechanics, Springer, Second Edition, 2007
2. The Sound of Numbers, Rachel Wells Hall, Math Horizons, May 31, 2008, http://people.sju.edu/~rhall/proposal.pdf
3. Math for Poets and Drummers; Rachel Wells Hall, Report from the Dept. Of Mathematics and Computer Science, Saint Josephs University, May 31, 2008, http://people.sju.edu/~rhall/Rhythms/P

REFERENCE BOOKS/MATERIAL

1. Some mathematical tools for music making, Miller Puckette, Conference on Art+Math, Boulder Colorado, 2005. http://msp.ucsd.edu/Publications/artmath-reprint.pdf
2. Fourier Analysis and Applications to Sound Processing, University of Oslo, Mathematics in Natural Sciences, 2017,
3. http://www.uio.no/studier/emner/matnat/math/MAT-INF2360/v12/part1.pdf
4. Wireless Body Area Networks – a survey; S Movassaghi et. al., IEEE Communication Surveys and Tutorials, Vol 16, 2014
5. MAC Protocols for Wireless BANs, B Touijer, YB Maissa and S Mouline, Wireless Communications and Mobile Computing Conference, 2017
6. Communication Protocols for BANs, LETI, 2012, http://www.capdigital.com/wp-content/uploads/2012/11/Atelier_Wear-a-BAN_Presentation_CEA-pdf.pdf
7. Overview of the System Integration Process, NDDOT, 2008, https://www.dot.nd.gov/divisions/maintenance/docs/OverviewOfSEA.pdf.
8. Northrop Grumann, Best Practices for System Integration, https://indiastorage.blob.core.usgovcloudapi.net/ndia/2011/system/13007_HouserThursday.pdf

COURSE OUTCOMES (COs):

1. The state space systems approach can be used to model the Biomechanics of human movement **(PO1, 2, 3, 4, 6; PSO 1, 2)**
2. Engineering mathematics and signal processing can be used to analyze music and creation of music **(PO1, 2, 3, 4, 5, 6, 9, 10, 12; PSO 1, 2, 3)**
3. Embedded systems theory can be used to measure and analyze human movement and music **(PO1, 2, 3, 4, 5; PSO 1, 2)**
4. Communication systems, in the form of Body Area Networks, can be used to sense and communicate vital information about body parameters in real time **(PO 1, 2, 3, 4, 5, 6, 9, 10; PSO 1, 2, 3)**
5. Some basics of System integration provides a holistic view of how different technologies are brought together into a single working system **(PO1, 2, 3, 4, 9, 10, 12; PSO: 1, 2, 3)**

MEMS

Course Code: TCE25 **Credit: 4: 0: 0: 0**
Course Co-coordinator: H. R. Ramya **Contact Hours: 56**
Pre-requisites: Micro Electronics (TC43)

Course Content

UNIT 1

Introduction to MEMS: Historical background of Micro Electro Mechanical Systems, Feynman's vision, multi-disciplinary aspects, basic technologies, application areas, scaling laws in miniaturization, scaling in geometry, electrostatics, electromagnetics, electricity and heat transfer.

UNIT 2

Micro Systems – Principles: Transduction principles in MEMS Sensors: Various sensing mechanisms, Actuators: different actuation mechanisms - silicon capacitive accelerometer, piezo-resistive pressure sensor, blood analyzer, conductometric gas sensor, silicon micro-mirror arrays, piezo-electric based inkjet print head, electrostatic comb-driver, Smart phone applications, Smart buildings

UNIT 3

Materials and Micro manufacturing: Semiconducting materials, Silicon, Silicon dioxide, Silicon Nitride, Quartz, Poly silicon, Polymers, Materials for wafer processing, Packaging materials Silicon wafer processing, lithography, thin-film deposition, etching (wet and dry), wafer-bonding, Silicon micromachining: surface, bulk, LIGA process, Wafer bonding process.

UNIT 4

Electrical and Electronics Aspects: Electrostatics, Coupled electro mechanics, stability and Pull-in phenomenon, Practical signal conditioning circuits for microsystems, RF MEMS: Switches, varactor, tuned filters, Application circuits based on microcontrollers for pressure sensor, Accelerometer.

UNIT 5

Integration and Packaging of Micro electromechanical Systems: Integration of microelectronics and micro devices at wafer and chip levels, Microelectronic packaging: wire and ball bonding, flip chip, Microsystem packaging examples, Testing of Micro sensors, Qualification of MEMS devices.

TEXT BOOKS

1. G. K. Anantha suresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Aatre, "Micro and Smart Systems", Wiley India, First edition, 2010
2. T R Hsu, "MEMS and Microsystems Design and Manufacturing", Tata McGraw Hill, 2nd Edition, 2008

REFERENCE BOOKS

1. Chang Liu, “Foundations of MEMS”, Pearson International Edition, 2012
2. S D Senturia, “Microsystem Design”, Springer International Edition, 2004

COURSE OUTCOMES (COs):

1. Understand the multidisciplinary and scaling aspects of Micro systems. **(PO1, 2, 3, 4, 8, 10) (PSO3)**
2. Analyze the various transduction mechanisms and applications of MEMS. **(PO 1, 2, 3, 4, 8, 9, 10, 11) (PSO3)**
3. Understand the various fabrication processes of MEMS devices. **(PO, 2, 9, 10, 12) (PSO3)**
4. Analyze the electronics aspects of MEMS systems. **(PO1, 2, 8, 10, 11, 12) (PSO3)**
5. Describe various packaging methods for MEMS devices. **(PO, 2, 9, 10, 12) (PSO3)**

AUTOMOTIVE ELECTRONICS

Course Code: TCE26 **Credit: 3: 0: 0: 1**
Course Coordinator: Dr. S. G. Shivaprasad Yadav **Contact Hours: 42**
Prerequisite Courses: 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)**

GROUP C: COMMUNICATION AND SIGNAL PROCESSING

SOFTWARE DEFINED RADIO

Course Code: TCE33 **Credit: 3: 0: 0: 1**
Course Coordinator: Dr. Umesharaddy **Contact Hours: 42**
Prerequisite: Digital Circuit Design (TC33)

Course Content

UNIT 1

Introduction: Introduction to ASICs and FPGAs, Digital design flow using FPGAs, CAD tools, Memory, PLDs: Realization of combinational and sequential circuits using PROM, PLA and PAL.

UNIT 2

Software Models: Data types and operators – switch Level Modeling-Gate Level Modeling – Data Flow Modeling – Behavioral Modeling-structural modeling –Design of combinational logic and sequential logic circuits-Design of Memory module and Finite state machines-test benches.

UNIT 3

FPGA Based Systems: Introduction-basic concepts-Digital design with FPGAs-FPGA based system design, FPGA Fabrics.

CPLD AND FPGA Architecture: Xilinx CPLD architectures, Xilinx FPGA architectures, Configurable logic blocks, I/O blocks, programmable interconnects, programming technologies.

UNIT 4

Software Radio: Block Diagram of Software Radio –Numerically controlled oscillator – Digital Up converters / Down Converters – Sampling schemes-Coherent Modulator and Demodulator - Incoherent Demodulation – digital approach for I and Q generation- Filter design(CIC) - baseband processing techniques.

UNIT 5

System Design: Design of Digital signal processing blocks- FFT, IFFT, FIR filters – crest factor reduction, digital pre distortion blocks- Turbo coders -OFDM modulators/demodulators, Network security-AES encryption- decryption modules.

Self-Study:

1. Behavioral, Structural, and Data flow modeling using verilog HDL.(Unit-1)
2. Mixed type and switch level modeling using verilog HDL.(Unit-2)

3. Behavioral description for stepper/DC motor ADC/DAC using verilog HDL.(Unit-3)
4. IIR/FIR Filter design using verilog HDL.(Unit-4)
5. Implementation of Modulator and Demodulator using verilog HDL.(Unit-5)
6. Behavioral description for data encryption and decryption using verilog HDL.(Unit-5)

TEXT BOOKS

1. Bob Zeidman, "Designing with CPLDs and FPGAs", CMP, 2002.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall, 2003.
3. Wayne Wolf, "FPGA based system design", Reprint 2005, Pearson Education.
4. Jeffrey H Reed, "Software Radio: A Modern Approach to Radio Engineering", Prentice Hall, 2002.

REFERENCES

1. Mitra S K, "Digital Signal Processing", Tata McGraw Hill, 2005.
2. Uwe Meyer Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, 2007.
3. Stephen Brown, "Fundamentals of Digital Logic with Verilog Design", Tata McGraw-Hill

COURSE OUTCOMES (COs):

1. Describe Digital design flow using PLDs and FPGAs.**(PO1, 2, 3, 5, 6, 12) (PSO 1, 2, 3)**
2. Define, classify, compare and design different types of descriptions using Verilog HDL. **(PO1, 2, 3, 5,12) (PSO 1, 3)**
3. Design, describe, distinguish, illustrate and evaluate complex digital circuits using FPGA and CPLD Architecture. Analyze the basic CLBs in FPGA. **(PO1, 2, 3, 5, 6, 12) (PSO 1, 2, 3)**
4. Describe and design Software Defined Radio.**(PO1, 2, 4, 5, 6, 7, 12) (PSO 1, 2, 3)**
5. Construct and implement different types of filters used in MODEM using FPGA **(PO1, 2, 3, 4, 5, 6, 12) (PSO 1, 2, 3)**

MULTIMEDIA COMMUNICATION

Course Code: TCE34 **Credit : 3:0:0:1**
Course Coordinator: Venu. K. N. **Contact Hours: 42**
Prerequisites: Digital Communication (TC61)

Course Content

UNIT 1

Multimedia Communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, media types.
Self-Study topic: network QoS application QoS

UNIT 2

Multimedia Information Representation: Text, images, audio and video, Text and image compression, text compression,
Self-Study Topic: image compression.

UNIT 3

Audio and Video Compression: Audio and video compression, audio compression, video compression, video compression principles, video compression standards: H.261, H.263, P1.323, MPEG 1, MPEG 2.
Self-Study topic: coding formats for text, speech, image and video.

UNIT 4

Standards for Multimedia Communications: Standards relative to interactive applications over the internet, standards for entertainment applications, error detection methods, transmission systems, PSTN modems,
Self-study Topic: switching systems and signaling systems.

UNIT 5

Broadband ATM Networks, Entertainment Networks and high Speed Modems: Introduction, cell format and switching principles, switch characteristics, protocol architecture, ATM LANs, Cable TV networks, satellite television networks, terrestrial television networks
Self-study Topic: high speed PSTN access technologies

TEXT BOOKS:

1. Fred Halsall, “Multimedia Communications: Applications, Networks, Protocols and Standards” , Pearson Education, Asia, Second Indian reprint 2002

REFERENCE BOOKS:

1. Nalin K. Sharda, “Multimedia Information Networking”, PHI, 2003
2. Prabhat K. Andleigh, Kiran Thakrar, “Multimedia Systems Design”, PHI, 2004.

COURSE OUTCOMES (COs):

1. Gain knowledge on different types of media **(PO1, 2, 3, 4,7) (PSO1,2)**
2. Representation of media and compression principles of text and images **(PO1, 2,3) (PSO1)**
3. Understand how audio and video are been compressed **(PO1, 2, 3, 4, 5,12)**
4. Gain knowledge about standards of multimedia communication and interactive applications **(PO1,2,3,4) (PSO1)**
5. Understand the working of broadband ATM networks **(PO1, 2, 3, 4, 6) (PSO1,2)**

DSP ALGORITHMS AND APPLICATIONS

Course Code: TCE35 **Credit: 4: 0: 0: 0**
Course Coordinator: Dr. S G Shivaprasad Yadav **Contact Hours: 56**
Prerequisites : Digital Signal Processing (TC51)

Course Content

UNIT 1

Introduction to basic features of Digital Signal Processing Devices: Introduction, A Digital Signal-Processing System, Digital Filters, Decimation and Interpolation. Basic Architectural features, DSP computational building blocks, Bus Architecture and Memory, Address generation unit, Speed issues.

UNIT 2

Introduction to Basic DSP Algorithms and its Implementation using Basic DSP processor: The Q-notation, FIR filters, IIR Filters, Interpolation Filters, Decimation Filters, 2-D Signal Processing, FFT implementation.

UNIT 3

ARCHITECTURE OF TMS320C6X PROCESSOR: Introduction, TMS320C6x architecture, Functional units, Fetch and execute packets, Pipelining, Registers, Linear and circular addressing modes, Interrupts

UNIT 4

TMS320C6x INSTRUCTIONS, MEMORY CONSIDERATIONS and Adaptive Filters: Introduction to different types of C6x Instruction sets with examples, Assembly Code Format, Assembler directives
Memory Considerations: Data Allocation and Alignment, Program Directives, Memory Models, Fixed- And Floating-Point Format, Code improvement constraints,
Adaptive Filters: Introduction to adaptive filters Adaptive structures, Algorithms and implementation

UNIT 5

DSP Applications: Applications of Programmable DSP Devices: DSP-based biotelemetry Receiver, A Speech Processing system, An Image processing system, A position Control system for a Hard disk drive, DSP-Based Power Meter

TEXT BOOKS

1. Rulph Chassaing and Donald Reay, "DSP and Applications with the TMS320C6713 and TMs320C6416 DSK", 2nd Edition, John Wiley Publications, 2008
2. Avatar Singh and S Srinivasan, "Digital Signal Processing", Thomson Learning, 2004

REFERENCE BOOKS

1. B Venkataramani and M Bhaskar, "Digital Signal Processors", TMH, 2002.
2. V. Udayshankara, "Modern DSP", PHI Publication, 2nd Edition, 2012

COURSE OUTCOMES (COs):

1. Describe the Basic Principles of DSP and Basic Architectural features of DSP devices. **(PO 1, 2, 3, 8) (PSO1, 2)**
2. Analyze the implementation of DSP algorithms using basic DSP processor (**PO1, 2, 3, 4, 5, 8) (PSO 1, 2)**
3. Interpret the architectural details of TMS320C67xx processor **(PO1, 2, 3, 4, 5, 8. 9, 12) (PSO 1, 2, 3)**
4. Analyze Addressing modes, instruction sets and the memory considerations of TMS320C67xx processor and design of adaptive filters **(PO 1, 2, 3, 4, 5, 8) (PSO 1, 2, 3)**
5. Interpret the applications of DSP Devices. (**PO 1, 2, 3, 4, 5, 8, 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 transform 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)**

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)**

INTERNSHIP

Course Code: TCIN
Credit: 0: 0: 4: 0

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, 3, 4, 6, 7, 9, 11, 12) (PSO 1, 2, 3)**
2. Identify the clear objectives & methodology for implementing the project by visualizing the Hardware and Software **(POs 1, 2, 3, 4, 6, 7, 9, 11, 12) (PSO 1, 2, 3)**
3. Design and Implementation of identified Problem using appropriate modern tools and Techniques in the area of telecommunication/ multidisciplinary areas **(POs 1, 2, 3, 4, 5, 6, 7, 9, 11, 12) (PSO 1, 2, 3)**
4. Validate the achieved results and demonstrate good project defense, presentation skills, leadership and punctuality as a team/individual **(PO 1, 2, 8, 9, 10, 11, 12) (PSO 1, 3)**
5. Ability to write the thesis following ethical values and 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)**