RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2019 – 2020

ELECTRONICS AND COMMUNICATION 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 150 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 64th rank in 2019 among the top 100 engineering colleges across India.

About the Department

The Department of Electronics and Communication was started in 1975 and has grown over the years in terms of stature and infrastructure. The department has well equipped simulation and electronic laboratories and is recognized as a research center under VTU. The department currently offers a B. E. program with an intake of 120, and two M. Tech programs, one in Digital Electronics and Communication, and one in VLSI Design and Embedded Systems, with intakes of 30 and 18 respectively. The department has a Center of Excellence in Food Technologies sponsored by VGST, Government of Karnataka. The department is equipped with numerous UG and PG labs, along with R & D facilities. Past and current research sponsoring agencies include DST, VTU, VGST and AICTE with funding amount worth Rs. 1 crore. The department has modern research ambitions to develop innovative solutions and products and to pursue various research activities focused towards national development in various advanced fields such as Signal Processing, Embedded Systems, Cognitive Sensors and RF Technology, Software Development and Mobile Technology.

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 central Quality Management System complemented by the synergistic interaction of the stakeholders concerned.

Vision of the Department

To evolve into a department of national and international repute for excellence in education and cutting-edge research in the domain of Electronics and Communication Engineering

Mission of the Department

The department will continuously strive to

1. *Provide a world-class learning environment that caters to local and global technological and social requirements*
2. *Initiate research collaborations with academia and industries to perform cutting edge research leading to socio-technological innovations*
3. *Develop skills for pursuing innovation and entrepreneurial ventures for graduating engineers*

Program Educational Objectives (PEOs):

PEO1: *To train to be employed as successful professionals in a core area of their choice*

PEO2: *To participate in lifelong learning/ higher education efforts to emerge as expert researchers and technologists*

PEO3: *To develop skills in ethical, professional, and managerial domains*

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: ***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.*

PO3: ***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.*

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 team work:*** *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: ***Circuit Design Concepts:*** *Apply basic and advanced electronics for implementing and evaluating various circuit configurations*

PSO2: ***VLSI and Embedded Domain:*** *Demonstrate technical competency in the design and analysis of components in VLSI and embedded domains*

PSO3: ***Communication Theory and Practice:*** *Possess application level knowledge in theoretical and practical aspects required for the realization of complex communication systems*

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/ Internship (PW/IN)	Extra & Co-curricular activities (EAC)	Total Credits in a Semester
First	02	09	14						**25**
Second	04	09	12						**25**
Third		08	07	10					**25**
Fourth		04		21					**25**
Fifth	02			19	04				**25**
Sixth				15	04		06		**25**
Seventh				14	12				**26**
Eighth						04	18	02	**24**
Total	**08**	**30**	**33**	**79**	**20**	**04**	**24**	**02**	**200**

SCHEME OF TEACHING

VII SEMESTER

SI. No.	Course Code	Course Title	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	EC71	Wireless and Data Communication	PS-C	3	0	0	1	4	3
2.	EC72	Information Theory and Coding	PS-C	3	1	0	0	4	5
3.	EC73	Embedded System Design	PS-C	4	0	0	0	4	4
4.	ECExx	Departmental Elective	PS-E	3	0	0	1	4	3
5.	ECExx	Departmental Elective	PS-E	3	0	0	1	4	3
6.	ECExx	Departmental Elective	PS-E	3	0	0	1	4	3
7.	ECL74	Wireless & Data Communication Laboratory	PS-C	0	0	1	0	1	2
8.	ECL75	Embedded System Design Lab	PS-C	0	0	1	0	1	2
			Total	**19**	**1**	**2**	**4**	**26**	**25**

VIII SEMESTER

SI. No.	Course Code	Course Title	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	xxOExx	Open Elective	OE	4	0	0	0	4	4
2.	ECIN	Internship/Departmental Elective (Industry collaborated course)	IN	0	0	4	0	4	8
3.	ECP	Project Work	PW	0	0	14	0	14	28
4.	EAC	Extra Curricular/Co-Curricular Activities	EAC	0	0	2	0	2	4
			Total	**4**	**0**	**20**	**0**	**24**	**44**

LIST OF ELECTIVES

SI. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1.	ECE18	Internet of Things (IoT)	3	0	0	1	4
2.	ECE19	Multi-resolution Signal Processing	3	0	0	1	4
3.	ECE20	Error Control Coding	3	0	0	1	4
4.	ECE21	Cyber Security	3	0	0	1	4
5.	ECE22	Optical Communication Networks	3	0	0	1	4
6.	ECE23	Multimedia Communication	3	0	0	1	4
7.	ECE24	Real Time Operating Systems (RTOS)	3	0	0	1	4
8.	ECE25	Satellite Communication and GPS	3	0	0	1	4
9.	ECE26	Wireless Networks	3	0	0	1	4
10.	ECE27	Cryptography	3	0	0	1	4
11.	ECE28	Advanced Computer Architecture	3	0	0	1	4

WIRELESS AND DATA COMMUNICATION

Course Code: EC71 **Credits: 3:0:0:1**
Pre requisites: Digital Communication **Contact Hours: 42**
Course Coordinators: Flory Francis, T.D. Senthilkumar

UNIT – I

Network Models: Introduction, OSI Model Layers, TCP/IP Suite

Data Link Control: Introduction to data link layer, Point-to-Point Protocol

Multiple Accesses: Random access – CSMA/CD, CSMA/CA, and Channelization

UNIT – II

Wired LANs: Ethernet, IEEE standards, Standard Ethernet

Network Layer: Logical addressing IPv4 and IPv6 Addresses, IPv4 and IPv6 format, Unicast Routing Protocols

Transport layer: Process to Process delivery, UDP, TCP

UNIT – III

Cellular Concepts: Frequency reuse, channel assignment, hand off, interference and system capacity, improving coverage and capacity in cellular systems – cell splitting, cell sectoring, microcell zone concept.

Mobile Radio Propagation – Large Scale Path Loss: Free space propagation model, Relating power to electric field – Reflection, Diffraction, Scattering, Link budget design, log-distance path loss models, log normal shadowing.

UNIT – IV

Mobile Radio Propagation – Small Scale Fading and Multipath: Small scale multipath propagation – Parameter of mobile multipath channels – Types of small scale fading.

Diversity techniques: Polarization diversity, frequency diversity, time diversity and RAKE receiver, Space diversity – combining techniques and derivation of selection diversity improvement.

UNIT – V

Multiple Access Techniques: Introduction to multiple access techniques, FDMA, TDMA, CDMA and SDMA, Capacity of cellular FDMA, TDMA, and CDMA.

Mobile Communication Systems: Transmit diversity: 2x1 MISO system and 2x2 MIMO system example – Space Time Block Codes (STBC) and spatial multiplexing, Orthogonal Frequency Division Multiplexing (OFDM)

Self Study: HDLC protocol – HTTP & FTP protocols, Wireless LAN, Intersymbol interference, Rayleigh and Rician fading, Spread spectrum techniques, Examples of 2G/3G wireless systems: GSM, IS95, CDMA 2000, Introduction and features of LTE standards.

Textbooks:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2016.
2. T. S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Prentice Hall of India, 3rd Indian Reprint, 2010.

References:

1. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education, 2007.
2. James Kurose Keith Ross "Computer Networking", Pearson Education, 2017.
3. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
4. Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, "Fundamentals of LTE", Prentice Hall, Communications Engineering and Emerging Technologies, 2010.

Course Outcomes (COs):

1. Discriminate the functionality between the layers in OSI model and TCP/IP suite. (POs – 1, 2, 10, 12, PSO – 3)
2. Describe transport layer formats and the network layer routing algorithms in the internet. (POs – 1, 2, 10, 12, PSO – 3)
3. Employ cellular concept to improve capacity of cellular system with limited radio spectrum. (POs – 1, 2, 10, 12, PSO – 3)
4. Appreciate the importance of diversity technique in mobile fading channel. (POs –1, 2, 10, 12, PSO – 3)
5. Employ the concept of multiple access techniques in 4G/5G mobile communication standards. (POs – 1, 2, 10, 12, PSO – 3)

INFORMATION THEORY AND CODING

Subject Code: EC72 **Credits: 3:1:0:0**
Prerequisites: Digital Communication **Contact Hours: 70**
Course Coordinator: V. Nuthan Prasad

UNIT – I

Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences,

Source Coding: Prefix Codes, Source coding theorem, Kraft McMillan Inequality property – KMI. Encoding of the Source Output, Huffman codes, Arithmetic Coding, LZW Algorithm.

UNIT – II

Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint Probability Matrix, Mutual Information, Channel Capacity, Special Channel, Capacity of Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Continuous Channels.

UNIT – III

Linear Block Codes: Introduction, matrix description of linear block codes, Error detection and error correction capabilities of linear block codes, Single error correcting Hamming codes, Table lookup decoding using standard array.

UNIT – IV

Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) bit shift register, Syndrome calculation, Error detection and correction

UNIT – V

Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, code tree, Trellis and State Diagram, Viterbi decoding algorithm for the convolution code.

Textbooks:

1. K. Sam Shanmugham, "Digital and Analog Communication Systems", John Wiley Publications, 1996.
2. Muralidhar Kulkarni, "Information Theory and Coding", 1st Edition, Wiley Publications, 2015.
3. Shu Lin, Daniel J. Costello, "Error Control Coding", 2nd Edition, Pearson/Prentice Hall, 2004.

References:

1. Bernard Sklar, "Digital Communications", 2nd Edition, Pearson Education, 2007.
2. Ranjan Bose, "Information Theory, Coding and Cryptography", 2nd Edition, TMH Publication, 2007.
3. Khalid Sayood, "Introduction to Data Compression", 4th Edition, Elsevier, 2012.

Course Outcomes (COs):

1. Apply basics of information theory to compute entropy, information rate and design various coding techniques. (POs – 1, 2, 3, 4, PSOs – 1, 2)
2. Categorize various channels for information transmission and interpret Shannon's theorem in continuous channels. (POs – 2, 3, 4, PSOs – 1, 2)
3. Design Linear Block Codes for error detection and error correction. (POs –2, 3, 4,PSOs – 2, 3)
4. Model Cyclic Block Codes using shift register for error detection and correction. (POs – 2, 3, 4, PSOs – 2, 3)
5. Construct trellis diagrams for Convolution encoders and decode with Viterbi algorithm. (POs – 2, 3, 4, 5, PSOs – 2, 3)

EMBEDDED SYSTEM DESIGN

Course Code: EC73 **Credits: 4:0:0:0**
Prerequisites: Microcontrollers **Contact Hours: 56**
Course Coordinator: Lakshmi Shrinivasan & Suma K V

UNIT – I

Introduction to Embedded Systems: Embedded system vs General computing system, characteristics of an embedded system, quality attributes of embedded system, core of embedded system, memory, sensors and actuators, communication interfaces, Embedded firmware design approaches, embedded firmware development languages.

UNIT – II

ARM7 Processor Fundamentals: ARM Architecture, Registers, current program status register, pipeline, exceptions, interrupts and vector table, core extensions. Introduction to ARM Instruction Set: Data Processing Instructions, Branch Instructions.

UNIT – III

Introduction to ARM7 Instruction Set: Load Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, and Conditional Execution.

Introduction to the THUMB Instruction set: Thumb register usage, ARM7 – Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load – Store Instructions, Multiple register Load Store Instructions, Stack Instructions, and Software Interrupt Instruction.

UNIT – IV

Interrupts & Exception Handling in ARM7: Exception Handling Interrupts, Interrupt handling schemes, Design of system using GPIO's (LCD interface, 4 x 4 Keypad), Timers.

UNIT – V

Embedded/Real – Time Operating System Concepts: Architecture of the Kernel, Tasks & Task Scheduler, and Interrupt service Routine.

I/O peripherals: ADC, DAC, UART, SPI.

Textbooks:

1. Shibu K V, "Introduction to Embedded Systems", 2nd Edition, McGraw Hill Education, 2009.
2. Andrew N. Sloss, "ARM system Developers Guide", 1st Edition, Elsevier, 2008.

References:

1. K. V. K. K. Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dreamtech Press, 2005.
2. LPC2148 user manual.

Course Outcomes (COs):

1. Identify the requirements of an embedded system. (POs – 1, 3, PSO – 2)
2. Familiarize with the ARM architecture. (POs – 1, 3, 4, PSO – 2)
3. Write programs using ARM / THUMB instruction set (POs – 1, 2, 3, 4, PSO – 2)
4. Analyze the various ways of handling exceptions and interrupts in ARM processor. (POs – 1, 2, 4, PSO – 2)
5. Develop embedded C programs to interact with various built in peripherals of ARM 7. (POs –1, 2, 3, 4, PSO – 2)

WIRELESS AND DATA COMMUNICATION LABORATORY

Course Code: ECL74 **Credits: 0:0:1:0**
Pre requisites: Digital Communication Laboratory **Contact Sessions: 14**
Course Coordinators: Flory Francis and T.D. Senthilkumar

LIST OF EXPERIMENTS

Data Communication

1. Write a program for error detection using CRC-CCITT (16 bits) using C.
2. Write a program for a HLDC frame to perform bit stuffing and destuffing in a single frame.
3. Write a program for a HLDC frame to perform character stuffing and destuffing in a single frame.
4. Write a program for encryption and decryption of text.
5. Simulate a three node point-to-point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS2.
6. Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP agent between n1-n3. Apply relevant applications over TCP and UDP agents by changing the parameters and determine the number of packets sent by TCP/UDP using NS2.

Wireless Communication

1. Analyze the performance of Quadrature Amplitude Modulation (QAM) and M-ary Phase Shift Keying (PSK) scheme in AWGN channel, and compare the results with theoretical results.
2. Compute Bit Error Rate (BER) for different digital modulation schemes in frequency-flat and slowly varying fading channel.
3. Bit error rate analysis of digital communication receivers with Maximal Ratio Combining (MRC) receive diversity in frequency-flat and slowly varying fading channel.
4. Bit error rate analysis of digital communication receivers with Equal Gain Combining (EGC) receive diversity in frequency-flat and slowly varying fading channel.
5. Simulation of Direct Sequence Spread Spectrum (DSSS) techniques.
6. (a) Measurement of numerical aperture and attenuation loss in analog fiber optic link.
   (b) Data multiplexing using fiber optic link

Textbooks:

1. Behrouz A. Forouzan, “Data communication and Networking”, 5th Edition, Tata McGraw-Hill, 2012.
2. J. G. Proakis and M. Salehi, “Contemporary Communication Systems using MATLAB”, PWS Publishing Company, 2007.

References:

1. James F. Kurose and Keith W. Ross, “Computer Networking: A Top Down Approach”, 5th Edition, Addison Wesley, 2009.
2. Larry L. Peterson and Bruce S Davie, “Computer Networks: A Systems Approach”, 5th Edition, Elsevier, 2011.
3. T. S. Rappaport, “Wireless Communications: Principles and Practice”, 2nd Edition, Prentice Hall of India, Third Indian Reprint, 2010.

Course Outcomes (COs):

1. Examine the performance of the algorithms of OSI model layers. (POs – 1, 2, 3, 4, 5, PSO – 3)
2. Use simulators to evaluate the network performance in different layers like NS2. (POs – 1, 2, 3, 4, 5, PSO – 3)
3. Analyze the performance of the digital modulation receivers in AWGN and fading channel (POs – 1, 2, 3, 4, 5, PSO – 3)
4. Analyze the performance of diversity receiver in multipath fading channel. (POs – 1, 2, 4, 5, PSO – 3)
5. Examine the characteristics of analog and digital optical link. (POs – 1, 2, 4, 5, PSO – 3)

EMBEDDED SYSTEM DESIGN LABORATORY

Course Code: ECL75 **Credits: 0:0:1:0**
Prerequisite: Microcontrollers **Contact Sessions: 14**
Course Coordinator: Lakshmi Shrinivasan & Suma K V

LIST OF EXPERIMENTS

Part A: Assembly language programs

1. Search a key element "X" in a list of 'n' 16-bit numbers using binary search algorithm.
2. Sort a given set of 'n' 16-bit numbers in ascending order using bubble sort algorithm.
3. Reverse a given string and verify whether it is a palindrome or not. Display the appropriate message.
4. Compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.
5. Read the current time and date from the system and display it in the standard format on the screen.
6. ARM assembly language programs for data transfer, arithmetic, Thumb instructions and logical operations.
7. C Programs for matrix multiplication, matrix addition and sparse matrix implementation.

Part B: Interfacing programs

1. Familiarize I/O ports of LPC 2148 – on/off control of LEDs using switches.
2. Display a given string using the LCD display interface.
3. Interface keypad and display the key pressed on LCD.
4. Waveform generation using the internal DAC of LPC 2148.
5. Convert a given analog voltage to digital using ADC of LPC 2148.
6. Interface a DC motor and control the speed of it.
7. Design and display a 2 digit counter (using timer/counter/capture module of LPC 2148)

Textbooks:

1. Andrew N. Sloss, "ARM System Developers Guide", 1st Edition, Elsevier, 2008.
2. LPC 2148 user manual.

Reference:

1. Shibu K V, "Introduction to Embedded Systems", 2nd Edition, McGraw Hill Education, 2009.

Course Outcomes (COs):

1. Write ARM assembly level programs. (POs – 1, 2, 3, 4, 5, 9, 10, 12, PSO – 2)
2. Build subroutines using ARM/THUMB instructions. (POs – 1, 2, 3, 5, 9, PSO – 2)
3. Develop embedded C programs to interface display modules. (POs – 1, 2, 3, 4, 6, 10, PSO – 2)
4. Design embedded C programs to interact with data converters. (POs – 1, 2, 3, 4, 6, 10, PSO – 2)
5. Implement digital counter using internal timer module. (POs – 1, 2, 3, 4, 6, 10, PSO – 2)

INTERNSHIP

Course Code: ECIN **Credits: 0:0:4:0**

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 Hours/Week		Duration of Exam (Hrs)	Marks		Total Marks	Credits
		Lecture	Practical/ Field Work		IA	Exam		
ECIN	Internship	-	-	-	50	50	100	4

Course Outcomes (COs):

1. Analyze the working of complex technical systems/blocks. (POs – 1, 2, 3, 4, PSOs – 1, 2, 3)
2. Apply modern software tools effectively for design and development of complex technical blocks. (POs – 1, 2, 3, 4, 5, PSOs – 2, 3)
3. Appreciate the effectiveness of teamwork in completing complex tasks within deadlines. (PO – 9)
4. Appreciate the requirements for constant technology updation. (PO – 12)
5. Create quality technical report describing all aspects of the internship. (PO – 10)

PROJECT

Course Code: ECP **Credits: 0:0:14:0**

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 Hours/Week		Duration of Exam (Hrs)	Marks		Total Marks	Credits
		Lecture	Practical/ Field Work		IA	Exam		
ECP	Project	-	-	-	50	50	100	14

Course Outcomes (COs):

1. Display an ability to undertake research activities by formulating a hypothesis and testing through appropriate experiments. (POs – 1, 2, 3, 4, 10, PSO – 1)
2. Choose and use modern tools most suitable to the chosen technical problem. (POs – 5, 11, PSOs – 2, 3)
3. Analyze and evaluate technical block diagrams and propose suitable modifications to improve performance. (POs – 1, 2, 3, 4, 5, PSOs – 2, 3)
4. Work effectively as a member or a leader of a team. (POs – 9, 11)
5. Communicate technical content effectively through written report and oral presentations. (POs – 10, PSOs – 2, 3)

EXTRA AND CO-CURRICULAR ACTIVITIES

Course Code: EAC **Credits: 0:0:2:0**

Course Code	Course Name	No. of Hours/Week		Duration of Exam (Hrs)	Marks		Total Marks	Credits
		Lecture	Practical/ Field Work		IA	Exam		
EAC	Extra and Co-Curricular Activities	-	-	-	100	-	50	2

Course Outcomes (COs):

1. Apply basic engineering knowledge in competitive situations such as quizzes and tech-fests. (POs – 1, 2, 3, 4, 5)
2. Design and develop technical solutions that are beneficial to the society. (POs – 3, 4, 5, 6, 7)
3. Communicate technical and non-technical ideas effectively to audiences at different levels. (PO – 10)
4. Contribute productively to societal causes through their knowledge in technical domains. (POs – 6, 7, 8)
5. Participate effectively as part of a team to perform technical and non-technical activities. (PO – 9)

INTERNET OF THINGS (IoT)

Subject Code: ECE18 **Credits: 3:0:0:1**
Prerequisites: Microcontrollers **Contact Hours: 42**
Course Coordinator: Lakshmi S.

UNIT – I

Introduction & concepts: Definition and Characteristics of IoT, Things in IoT, IoT Protocols, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates, IoT and M2M, SDN and NFV for IoT, IoT System Management with NETCONFIG-YANG.

UNIT – II

Developing Internet of Things: IoT Platform Design Methodology, Specifications: Requirements, Process, Domain, Information, Services, Level, Functional, Operational, Integration, Application Development.

Python Language: Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date & Time Operations, Classes, Python Packages of Interest for IoT.

UNIT – III

IoT Physical Devices and End Points: Basic Building Blocks of an IoT Device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces: Serial, SPI, I2C.

Programming Raspberry Pi with Python: Controlling LED, Interfacing Switch, Interfacing Light Sensor.

UNIT – IV

Cloud and Data Analytics: Introduction to cloud storage Models and Communication APIs, Python.

Web Application Framework: Django, Web Services for IoT, SkyNet Messaging Platform, Data Analytics for IoT, Apache: Hadoop, Oozie, Storm, Real-Time Data Analysis, Tools for IoT.

UNIT – V

IoT Case Studies: Home Automation: Smart Lighting, Home Intrusion Detection; Cities: Smart Parking Environment: Weather Monitoring System, Weather Reporting Bot, Air Pollution Monitoring, Forest Fire Detection; Agriculture – Smart Irrigation, IoT Printer.

Self Study: Exploring programming using Raspberry Pi for application prototypes.

Textbook:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2015.

References:

1. Ovidiu Vermesan, Peter Friess, “Internet of Things – From Research and Innovation to Market Deployment”, River Publishers Series in Communication, June 2014.
2. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley Publications, 2013.

Course Outcomes (COs):

1. Describe the OSI Model for the IoT/M2M Systems. (POs – 1, 2, 12, PSO – 3)
2. Learn basics of design, integration and applications of IoT models. (POs –1, 2, 3, 12, PSO – 3)
3. Acquire the knowledge of basic blocks of IOT devices using Raspberry Pi. (POs – 1, 2, 3, 5, 12, PSO – 3)
4. Understand cloud storage models and web services for IoT. (POs – 1, 2, 4, 12, PSO – 3)
5. Appraise with various case studies. (POs – 1, 2, 3, 4, 5, 12, PSO – 3)

MULTI-RESOLUTION SIGNAL PROCESSING

Course Code: ECE19 **Credits: 3:0:0:1**
Prerequisites: Digital Signal Processing **Contact Hours: 42**
Course Coordinator: Maya V. Karki

UNIT – I

Time Frequency Analysis of Signals: Introduction, Short Time Fourier Transform, Gabor transform, Tiling in time frequency plane.

UNIT – II

Multi-resolution analysis: Scaling functions, Construction of wavelet basis MRA, Haar scaling functions and function spaces, nested spaces, Haar wavelet function

UNIT – III

Multi-scale Transforms: Discrete Wavelet Transform (DWT), Ridgelet Transform, Curvelet Transform, Contourlet Transform

UNIT – IV

Theory of Subband Decomposition: Introduction, Multirate systems, Polyphase Decomposition, Two Channel Filter bank, Biorthogonal filters, Lifting scheme, Applications of multirate filtering

UNIT – V

Applications of Multi-scale Transforms: Multitone modulation, Image denoising, Progressive pattern recognition, biomedical signal processing.

Self Study: DFT, STFT and Gabor transform on 1D non-stationary signal, Illustration of scale, frequency and translation on 1D non stationary signal, Application of multi-scale transforms on 2D signals, Implementation of sub-band adaptive filters, Image denoising using multi-scale transforms.

Textbooks:

1. K. P. Soman, K. I. Ramachandran, "Insight into Wavelets from Theory to Practice", 2nd Edition, Prentice Hall, 2005.
2. Agostino Abbate, Casimer DeCusatis, Pankaj K. Das, "Wavelets and Subbands: Fundamentals and Applications", Birkhäuser, 2002.
3. Aparna Vyas, Soowhan Yu, Joonki Paik, "Multiscale Transforms with Applications to Image Processing", Springer Nature Singapore Pvt. Ltd, 2018.

References:

1. P. P. Vaidyanathan, "Multirate systems and filter banks", 2nd Impression, Pearson Education, 2008.
2. M. Vetterli, I. Kovacevic, "Wavelets and Subband Processing", Prentice Hall, 1995.
3. L. Prasad, S. S. Iyengar, "Wavelet Analysis with Applications to Image Processing", CRC Press, 1997.
4. Ivan W. Selesnick, Richard G. Baraniuk, and Nick G. Kingsbury, "The Dual Tree Complex Wavelet Transform", IEEE Signal Processing Magazine, November 2005

Course Outcomes (COs):

1. Apply STFT and Gabor transform on a given signal (POs – 1, 2, 3, PSO – 3)
2. Analyze multi-scale signals and systems. (POs – 2, 3, 4, PSO – 3)
3. Apply various multi-scale transforms on a 2D signal. (POs – 2, 3, 4, 5, PSO – 3)
4. Construct poly phase decomposition and biorthogonal filters (POs – 2, 3, 4, 5, PSO – 3)
5. Employ multi-scale transforms for de-noising, pattern recognition and in biomedical signal analysis. (POs – 3, 4, 5, PSO – 3)

ERROR CONTROL CODING

Subject Code: ECE20 **Credits: 3:0:0:1**
Prerequisites: Information Theory and Coding **Contact Hours: 42**
Course Coordinator: V. Nuthan Prasad

UNIT – I

Introduction to algebra: Groups, Fields, binary field arithmetic, Construction of Galois Field GF (2^m) and its properties, Computation using Galois filed GF (2^m) arithmetic, Vector spaces and matrices on Galois field.

UNIT – II

Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection and error correcting capabilities, Minimum distance considerations, decoding circuits, Hamming codes, Reed-Muller codes.

UNIT – III

Cyclic codes: Introduction, Generator and parity check polynomials, Encoding using multiplication circuits, Systematic cyclic codes – generator matrix for cyclic code, Encoding using feedback shift register circuits, Meggitt decoder, Error trapping decoding, Cyclic hamming codes, Golay code, Shortened cyclic codes.

UNIT – IV

BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field arithmetic, Implementation of error correction.

UNIT – V

Convolutional codes: Encoding of convolutional codes, Viterbi decoding algorithm for decoding, soft output Viterbi algorithm, Stack and Fano sequential decoding algorithms,

Self Study: Matrices on Galois field, Syndrome and error detection, Hamming codes, Generator matrix for cyclic code, Encoding using shift register circuit, Encoding of convolutional codes, Implementation of Hamming codes, cyclic codes, convolutional codes and Viterbi algorithm

Textbooks:

1. Shu Lin and Daniel J. Costello. Jr, "Error control coding", 2nd Edition, Pearson, Prentice Hall, 2010.
2. Blahut. R. E, "Theory and practice of Error control codes", Addison Wesley, 1984.

References:

1. Patrick Guy Farrell, Jorge Castineira Moreira, "Essentials of Error Control Coding", John Wiley & Sons, 2010.
2. Todd K.Moon, "Error Correcting Codes", 1st Edition, John Wiley & Sons, 2006.

Course Outcomes (COs):

1. Apply properties of Galois Field to Groups, Fields, Vector Spaces, row space and sub-spaces. (POs – 1, 2, 3, 4, PSO – 1)
2. Describe RM codes in error detection and error correction. (POs – 2, 3, 4, PSOs – 1, 3)
3. Demonstrate cyclic block codes in error detection and correction. (POs – 2, 3, 4, PSOs – 2, 3)
4. Illustrate various BCH Codes and apply them for error detection & correction. (POs –2, 3, 4, PSOs – 2, 3)
5. Construct higher-order error-control codes and use Viterbi & stack algorithms for decoding. (POs –2, 3, 4, PSOs – 2, 3)

CYBER SECURITY

Subject Code: ECE21 **Credits: 3:0:0:1**
Prerequisites: Cryptography **Contact Hours: 42**
Course Coordinator: Shreedarshan K

UNIT – I

Transport Level Security: Web Security Considerations, Secure Sockets Layer, HTTPS, Secure Shell (SSH)

UNIT – II

E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail

UNIT – III

IP Security: IP Security Overview, Encapsulation Security Payload (ESP), combining security Associations Internet Key Exchange.

UNIT – IV

Network Security: Security Architecture, anti-pattern: signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, Problems: cyber anti patterns concept, forces in cyber anti patterns, cyber anti pattern templates, cyber security anti pattern catalog

UNIT – V

Cyber Network Security: Enterprise security using Zachman framework, Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. Case study: cyber security hands on – managing administrations and root accounts, installing hardware, reimaging OS.

Self Study: Transport Layer Security, IP Security Policy, Cryptographic Suites, behavioral and entropy based malware detection, Case study: installing system protection/ antimalware, configuring firewalls.

Textbooks:

1. William Stallings, “Cryptography and Network Security Principles and Practice”, 6th Edition, Pearson Education Inc., 2014.
2. Thomas J. Mowbray, “Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions”, Wiley, 2014.

References:

1. Behrouz A. Forouzan, “Cryptography and Network Security”, 2nd Edition, TMH 2010.
2. Atul Kahate, “Cryptography and Network Security”, 3rd Edition, TMH, 2017.

Course Outcomes (COs):

1. Use basic transport level security to network systems. (POs – 1, 2, PSOs – 1, 3)
2. Illustrate e-mail security methods. (POs – 1, 2, PSOs – 1, 3)
3. Illustrate IP security techniques. (POs – 1, 2, 3, PSOs – 1, 3)
4. Generate some cyber anti pattern templates. (POs – 1, 2, 3, PSOs – 1, 3)
5. Solve patterns related to cyber security using different composite models. (POs – 1, 2, 3, PSOs – 1, 3)

OPTICAL COMMUNICATION NETWORKS

Subject Code: ECE22 **Credits: 3:0:0:1**
Prerequisites: Digital Communication **Contact Hours: 42**
Course Coordinator: M. Nagabushanam

UNIT – I

Optical fiber waveguides: Historical development, general system, Advantages of optical fiber communication, Optical fiber waveguides: Ray theory transmission, Modes in planar guide, Phase and group velocity, Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength.

UNIT – II

Transmission characteristics of optical fibers: Attenuation, material absorption losses, linear and nonlinear scattering loss, fiber bend loss, dispersion chromatic dispersion, intermodal dispersion, polarization, nonlinear effects.

Digital Links: Point to point links, system considerations, link power budget, rise time budget analysis.

UNIT – III

Optical Sources & Detector: Optical emissions from semiconductor, semiconductor/non semiconductor injection laser & structures, LED power & efficiency, optical detection principles, absorption, quantum efficiency, responsivity, semiconductor photo diodes with and without internal gain.

UNIT – IV

Client layers of the optical layer: SONET/SDH, Multiplexing SONET/SDH Layers, SONET Frame Structure SONET/SDH Physical Layer, optical transports Network, Ethernet, IP, Multiprotocol label switching.

UNIT – V

WDM System: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers, OADM Architectures, Reconfigurable OADMs, Optical Cross connects.

Self Study: Mode field diameter, effective refractive index, soliton propagation, LED structures and characteristics, resilient packet ring, All optical OXC Configurations

Textbooks:

1. John M. Senior, “Optical Fiber Communication: Principles and Practice”, 3rd Edition, PHI, 2010.
2. Rajiv Ramaswami, Kumar N. Sivarajan, Galen H. Sasaki, “Optical networks”, 3rd Edition, Morgan Kaufmann Publishers, 2010.
3. Gerd Keiser, “Optical Fiber Communications”, 5th Edition, McGraw Hill, 2015.

References:

1. Govind P. Agrawal, “Fiber Optic Communication System”, 3rd Edition, John Wiley and Sons, 2010.
2. Djafark Mynbaev and Lowell L. Scheiner, “Fiber Optic Communication Technology”, Pearson Education, 2006.

Course Outcomes (COs):

1. Describe the light propagation in an optical fiber waveguide. (POs – 1, 2, PSO – 3)
2. Apply the optical losses in the power budget estimation. (POs – 1, 2, 3, PSO – 3)
3. Appreciate the efficiency of optical sources and detectors in the optical communication system. (POs – 2, 3, 8, PSO – 3)
4. Demonstrate the principle of SONET/SDH standard in optical networks. (POs – 2, 3, 8, PSO – 3)
5. Demonstrate the principle of optical amplifiers and WDM components. (POs –2, 3, 8,PSO – 3)

MULTIMEDIA COMMUNICATION

Subject Code: ECE23 **Credits: 3:0:0:1**
Prerequisites: Information Theory and Coding **Contact Hours: 42**
Course Coordinator: Maya V. Karki

UNIT – I

Multimedia Communications and Information Representation: Introduction, multimedia information representation, multimedia networks, multimedia applications, application and networking terminology

UNIT – II

Multimedia operating systems and synchronization: Multimedia resource management and process management, Synchronization: Notion of synchronization, presentation requirements, reference model for synchronization, Synchronization specification.

UNIT – III

Text and Image Compression: Text and image representation, Compression Principles, Text compression: Huffman coding, Arithmetic coding, Dictionary based (LZW) coding, Image Compression: KL transform, DCT, Wavelet based compression (EZW), JPEG and JPEG 2000

UNIT – IV

Audio Compression Principles and Standards: Basic of audio compression techniques: ADPCM, Speech coding, Vocoders, Psychoacoustics, MPEG Audio Compression: MPEG layers, MPEG audio compression algorithm, MPEG – 2 and MPEG – 4, MPEG – 7 and MPEG –21.

UNIT – V

Video Compression Principles and standards: Introduction to video compression, Video compression based on motion compensation, search for motion vectors, H.261, H.263 and H.264 standard. MPEG – 1, MPEG – 2, MPEG – 4 and MPEG – 7 standards.

Self Study: Multimedia applications, Text and image representation, audio representation, Psychoacoustics, H.263, MPEG – 7 standards

Textbooks:

1. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Pearson Education, 2001.
2. Ze Nian Li, Mark S Drew, "Fundamentals of Multimedia" Pearson Edition, 2004.

References:

1. Raif Steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education, 2002.
2. K. Sayood, "Introduction to Data Compression", 3rd Edition, Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, 2012.

Course Outcomes (COs):

1. Understand the basics of multimedia communication**,** information representation, network terminology and multimedia applications. (POs – 1, 2, 4, PSO – 3)
2. Identify the requirements of multimedia operating systems and synchronization. (POs – 1, 2, 3, 4, PSO – 3)
3. Apply lossless and lossy compression techniques to text and images.(POs –2, 3, 4, 5, PSO – 3)
4. Demonstrate audio compression standards. (POs – 2, 3, 4, 5, PSO – 3)
5. Distinguish between various video compression standards. (POs – 2, 3, 4, 5, PSO – 3)

REAL TIME OPERATING SYSTEMS (RTOS)

Course Code: ECE24 **Credits: 3:0:0:1**
Prerequisite: Operating Systems **Contact Hours: 42**
Course Coordinators: Lakshmi Shrinivasan & Suma K V

UNIT – I

Introduction to Real Time Embedded Systems: Brief history of Real Time Systems and Embedded Systems.

System Resources: Resource Analysis, Real Time Service Utility, Scheduling Classes, The Cyclic Executive, Scheduler Concepts, Preemptive Fixed Priority Scheduling Policies, Real-Time OS, Thread Safe Reentrant Functions.

UNIT – II

Processing: Preemptive Fixed Priority Policy, Feasibility, Rate Monotonic least upper bound, and Necessary and Sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies.

I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture.

Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems.

UNIT – III

Multi-resource Services: Locking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion.

Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, mixed hard and soft real-time services.

Embedded System Components: Firmware components, RTOS system software mechanisms, Software application components.

UNIT – IV

Debugging Components: Exceptions assert, Checking return codes, Single-step debugging, kernel scheduler traces, Test access ports, Trace ports, Power-On self-test and diagnostics, External test equipment, Application-level debugging.

Performance Tuning: Basic concepts of drill-down tuning, hardware – supported profiling and tracing, Building performance monitoring into software, Path length, Efficiency, and Call frequency, Fundamental optimizations.

UNIT – V

High availability and Reliability Design: Reliability and Availability, Similarities and differences, Reliability, Reliable software, Available software, Design tradeoffs, Hierarchical applications for Fail-safe design.

Design of RTOS: PIC microcontroller.

Self Study: Programming in C on Linux platform, Implement Semaphore and pipes, realize IPC using message queues, pipes, socket programming, creating threads and multithreads using fork() function, setting up the different priority levels of threads, data transfer between parent and child process.

Textbooks:

1. Sam Siewert, "Real-Time Embedded Systems and Components", Indian Edition, Cengage Learning 2007.
2. Myke Predko, "Programming and Customizing the PIC microcontroller", 3rd Edition, TMH, 2008.

Reference:

1. Dr. K. V. K. K. Prasad, "Embedded/Real-Time Systems: Concepts, Design and Programming", Dreamtech Press, India, 2005.

Course Outcomes (COs):

1. Appreciate real time embedded systems. (POs – 1, 2, PSO – 2)
2. Select suitable scheduling techniques, I/O resource and real time memory for an embedded system. (POs – 1, 2, 3, 6, PSO – 2)
3. Interpret the soft real time services, multi resource sharing and various embedded system components in real time system design. (POs – 1, 2, 3, 5, PSO – 2)
4. Analyze and use software debugging components and performance tuning methods. (POs – 1, 2, 3, 7, PSO – 2)
5. Utilize and build a RTOS API for a given microcontroller. (POs – 1, 3, 5, PSO – 2)

SATELLITE COMMUNICATION AND GPS

Course Code: ECE25 **Credits: 3:0:0:1**
Prerequisite: Microwave Devices and Radar **Contact Hours: 42**
Course Coordinator: Akkamahadevi M B

UNIT – I

Introduction and Orbital Mechanics: Introduction, Kepler's Law, Orbital elements, Orbital perturbations, Launches and launch vehicles, launches with geostationary orbit with AKM launch.

UNIT – II

Space Segment: Power supply, Attitude and Control system, Spin stabilization, Momentum control, Telemetry, Tracking and Command Subsystems, Transponders, Low noise amplifier & Receivers, equipment reliability.

UNIT – III

Satellite Link Design: Basic transmission theory, System noise, Uplink, Concept of saturation of TWTA, Downlink, Combined uplink and downlink C/N ratio& Inter modulation noise system design example.

Satellite Services: Introduction, VSATs, GPS system and Orbcomm.

UNIT – IV

GPS System: Overview of the GPS System, Space Segment Description, Control Segment, User Segment.

UNIT – V

GPS Signal Acquisition and Tracking: GPS Receiver Code and Carrier Tracking, Measurement Errors and Tracking Thresholds, Signal Acquisition, Sequence of Initial Receiver Operations.

Self Study: Direct launch, Antenna subsystem, Satellite mobile services, Radar sat, Indian space program for civil aviation, working principle of GPS in mobile.

Textbook:

1. Dennis Roddy, "Satellite Communications", 4th Edition, Tata McGraw-Hill Education India, 2008.
2. Elliott D. Kaplan and Christopher J. Hegarty, "Understanding GPS Principles and Applications", 2nd Edition, Artech House Inc., 2006.

References:

1. Timothy Pratt, Charles W. Bostian, Jeremy E. Allnutt, "Satellite Communications", 2nd Edition , John Wiley & Sons, 2010.
2. Pratap Misra and Per Enge, "Global Positioning System – Signals, Measurements and Performance", 2nd Edition, Ganga Jamuna Press, 2010.

Course Outcomes (COs):

1. Identify the significance of Kepler's laws of orbital mechanism and perturbations. c (POs –1, 2,6 , PSO – 3)
2. Illustrate the subsystems of the satellite.(POs –1, 2, 6, PSO – 3)
3. Design of satellite link budget and analyze the different satellite services for practical applications.(POs – 1, 2, 6, PSO – 3)
4. Discuss the GPS system segments.(POs – 1, 2, 6, PSO – 3)
5. Describe the GPS signal acquisition and tracking.(POs – 1, 2, 6, PSO – 3)

WIRELESS NETWORKS

Subject Code: ECE26 **Credits: 3:0:0:1**
Prerequisites: Digital Communication **Contact Hours: 42**
Course Coordinators: Flory Francis, Mamtha Mohan

UNIT – I

Wireless Local Area Networks (WLANs): WLAN Standards – IEEE 802.11 and its variants, WLAN Protocols – Physical Layer Protocols, MAC Layer Protocols and WLAN applications.

Wireless Body Area Networks (WBANs): Protocols – Physical Layer techniques, MAC Layer Protocols, WBAN Technologies – Bluetooth, Zigbee, UWB and WBAN applications.

UNIT – II

Wireless Personal Area Networks (WPANs): Network Architecture- Piconet and Scatternet, WPAN Technologies and Protocols -IEEE 802.15.5: Mesh WPAN and WPAN Applications.

Wireless Metropolitan Area Networks (WMANs): WiMAX, Broadband Wireless Networks – WLL, LMDS, MMDS, WMAN Applications.

Wireless Wide Area Networks (WWANs): Interworking of WWAN and WWAN applications.

UNIT – III

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols. Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT – IV

MAC Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, Performance Requirements, Common Protocols, MAC Protocols for WSNs, Schedule-Based Protocols, Random Access-Based Protocols, Sensor-MAC, Case Study: Protocol Overview, Periodic Listen and Sleep Operations.

UNIT –V

Routing Protocols for Ad Hoc Wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, table drive routing protocol, On-demand routing protocol, Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

Self Study: WLAN applications, WBAN applications, WPAN Applications, WMAN Applications, WWAN applications, Classification of MAC protocols of Ad Hoc wireless networks, Common WSN MAC Protocols, Classification of routing protocols of Ad Hoc wireless networks.

Textbooks:

1. P. Kaveh and Krishnamurthy, "Principles of Wireless network: A unified approach", 1st Edition, Prentice Hall, 2006.
2. OzanK. Tonguz and Gianguigi Ferrari, "AdHoc Wireless Networks: A Communication – Theoretic Perspective", 1st Edition, John Wiley & Sons, 2009.
3. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks – An InformationProcessing Approach", 1st Edition, Elsevier, 2007.

References:

1. Sunilkumar. S. Manvi, and Mahabaleshwar. S. Kakkasageri, "Wireless and Mobile Networks - Concepts and Protocols", 1st Edition, John Wiley India Pvt. Ltd., 2010.
2. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks", 2nd Edition, Pearson Education, 2008.
3. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

Course Outcomes (COs):

1. Discuss the standards of WLANs and WBANs. (POs – 1, 6, 7, PSO –3)
2. Describe the significance of WPANs, WMANs and WWANs. (POs – 1, 6, 7, PSO – 3)
3. Explain the MAC protocols for Ad Hoc wireless networks. (POs – 1, 6, 7, PSO –3)
4. Summarize the MAC Protocols for Wireless Sensor Networks. (POs – 1, 6 ,7, PSO –3)
5. Outline the Routing Protocols for Ad Hoc Wireless Networks. (POs – 1, 6,7, PSO –3)

CRYPTOGRAPHY

Subject Code: ECE27 **Credits: 3:0:0:1**
Prerequisites: Digital Communication **Contact Hours: 42**
Course Coordinator: Shreedarshan K

UNIT – I

Basic Concepts of Number Theory and Finite Fields: Divisibility and the divisibility algorithm, Euclidean algorithm, Modular arithmetic, Groups, Finite fields of the form GF(p), Polynomial arithmetic, Finite fields of the form GF(2n), Prime Numbers, Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete logarithm.

UNIT – II

Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Steganography

Symmetric Ciphers: Data encryption standard (DES)

UNIT – III

Symmetric Ciphers: The AES Cipher.

Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs

UNIT – IV

Principles of Public-Key Cryptosystems: The RSA algorithm, Diffie - Hellman Key Exchange, Elgamal Cryptosystem, Elliptic Curve Arithmetic, Elliptic Curve Cryptography

UNIT – V

Digital Watermarking Fundamentals: Differences between watermarking and steganography, Applications of steganography, Least Significant-bit substitution, Spatial Domain Watermarking, Frequency Domain watermarking, Fragile Watermark.

Self Study: Rings and Fields, Transposition techniques, Traditional Block Cipher structure, Classification in Digital Watermarking based on characteristics and applications, Types of Steganography, Random Sequence Generation.

Textbooks:

1. William Stallings, "Cryptography and Network Security Principles and Practice", 6th Edition, Pearson Education Inc., 2014.
2. Frank Y. Shih, "Digital Watermarking and Steganography", CRC Press, 2012.

References:

1. Behrouz A. Forouzan, "Cryptography and Network Security", 2nd Edition, TMH, 2010.
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, TMH, 2017.

Course Outcomes (COs):

1. Use basic cryptographic algorithms to encrypt the data. (POs – 1, 2, PSOs – 1,3)
2. Generate some pseudorandom numbers required for cryptographic applications. (POs – 1 ,2, PSOs – 1, 3)
3. Apply symmetric cipher for digital data. (POs – 1, 2, 3, PSOs – 1, 3)
4. Realize asymmetric cipher algorithms using digital data. (POs – 1, 2, 3, 4, PSOs – 1, 3)
5. Perform techniques involving digital watermarking and steganography. (POs – 1, 2, 3, 4, PSOs – 1, 3)

ADVANCED COMPUTER ARCHITECTURE

Subject Code: ECE28 **Credits: 3:0:0:1**
Prerequisites: Computer Organisation **Contact Hours: 42**
Course Coordinators: Maya V. Karki, V. Anandi

UNIT – I

Parallel Computer Models: Multiprocessors and multicomputer, Multi vectors and SIMD computers.

Program and Network Properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling.

UNIT – II

Program flow mechanisms: Data flow Architecture, Demand driven mechanisms.

Principles of Scalable Performance: Parallel Processing Applications, Speedup Performance Laws, Scalability Analysis and Approaches.

UNIT – III

Speedup Performance Laws: Amdhal's law, Gustafson's law, Memory bounded speedup model, Scalability Analysis and Approaches.

Advanced Processors: CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures.

UNIT – IV

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design

Memory Hierarchy Design: Multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

UNIT – V

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, scalable cache coherence, design challenges of directory protocols, memory based directory protocols, cache based directory protocols.

Self Study : The state of computing, Classification of parallel computers, Grain Size and latency, Control flow versus data flow, Comparisons of flow mechanisms, Performance Metrics and Measures, Advanced processor technology, Instruction-set Architectures, Cache basics & cache performance, reducing miss rate and miss penalty, cache coherence protocols (MSI, MESI, MOESI), overview of directory based approaches

Textbook:

1. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", 1st Edition, Tata McGraw Hill, 2003.

References:

1. Kai Hwang and Zu, “Scalable Parallel Computers Architecture”, Tata McGraw Hill, 2003.
2. M.J. Flynn, “Computer Architecture, Pipelined and Parallel Processor Design”, Jones & Bartlett Learning, 1995.
3. D.A. Patterson, J.L. Hennessy, “Computer Architecture: A Quantitative Approach”, 5th Edition, Morgan Kaufmann, 2012.

Course Outcomes (COs):

1. Illustrate understanding of contemporary computer architecture issues and techniques. (POs –1, 2, 6, PSO – 2)
2. Discuss the role of parallelism in current and future architectures.(POs – 2, 3, 6, PSO – 2)
3. Analyse the behavior of a pipeline as the processor executes various sequences of instructions.(POs –2, 3, 4, 12, PSO – 2)
4. Apply concept and principle of cache and virtual memory to high-performance computer architecture. (POs – 1, 2, 3,5 , PSO – 2)
5. Compare different multiprocessor architectures and cache coherence protocols. (POs – 2, 3, 6, PSO – 2)