RAMAIAH
Institute of Technology

CURRICULUM

Academic year 2023 – 2024

ELECTRONICS AND COMMUNICATION 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 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^+' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. 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 67% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for 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, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, 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. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute 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 (NIRF), MoE, Government of India, Ramaiah Institute of Technology has achieved 78th rank among 1314 top Engineering Institutions & 23rd Rank for School of Architecture in India for the year 2023.

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 M. S. 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 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: *Acquire knowledge and skills to be employed as successful professionals in their chosen careers*

PEO2: *Emerge as technologists, researchers, and entrepreneurs through lifelong learning*

PEO3: *Demonstrate social, ethical, and leadership skills*

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: ***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*

Distribution of Credits for the Batch of 2020 – 2024

Course Category	1st	2nd	3rd	4th	5th	6th	7th	8th	Total
Basic Science (BSC)	9	8	4	4					25
Engineering Science (ESC)	11	10							21
Humanities and Management (HSMC)	2	2			3		3		10
Professional Courses – Core (PCC)			21	21	15	11	10		78
Professional Courses – Elective (PCE)					3	6	6		15
Open Elective (OE)					3	3			06
Project Work (PW)						4	1	15	20
Total	22	20	25	25	24	24	20	15	175

SCHEME OF TEACHING (2021 – 2022)
VII SEMESTER

Sl. No.	Course Code	Course Title	Category	Credits				Contact Hours
				L	T	P	Total	
1.	EC71	Internet of Things	PCC	4	0	0	4	4
2.	EC72	Wireless and Data Communication	PCC	3	1	0	4	5
3.	EC73	IPR	HSMC	3	0	0	3	3
4.	ECE74x	Department Elective – 4	PCE	3	0	0	3	3
5.	ECE75x	Department Elective – 5	PCE	3	0	0	3	3
6.	ECL76	Wireless and Data Communication Laboratory	PCC	0	0	1	1	2
7.	ECL77	IoT Laboratory	PCC	0	0	1	1	2
8.	ECS	Technical Seminar	Project	0	0	1	1	2
Total				**16**	**1**	**3**	**20**	**24**

VIII SEMESTER

Sl. No.	Course Code	Course Title	Category	Credits				Contact Hours
				L	T	P	Total	
1.	ECIN	Internship/NPTEL Course	PW	0	0	3	3	6
2.	ECP	Project Work	PW	0	0	12	12	24
Total				**0**	**0**	**15**	**15**	**30**

LIST OF DEPARTMENT ELECTIVES

Sl. No.	Course Code	Course Title	Credits			
			L	T	P	Total
V Semester (Elective I)						
1.	ECE551	Information, Learning and Inference	3	0	0	3
2.	ECE552	Advanced Digital Design	3	0	0	3
3.	ECE553	Operating Systems	3	0	0	3
4.	ECE554	Computer Architecture	3	0	0	3
VI Semester (Elective II)						
5.	ECE631	Image and Video Processing	3	0	0	3
6.	ECE632	Advanced Digital Logic Verification	3	0	0	3
7.	ECE633	Error Control Coding	3	0	0	3
8.	ECE634	Robotics	3	0	0	3
VI Semester (Elective III)						
9.	ECE641	Radars and Satellite Communication	3	0	0	3
10.	ECE642	Machine and Deep Learning	3	0	0	3
11.	ECE643	Speech and Audio Processing	3	0	0	3
12.	ECE644	Low Power VLSI Design	3	0	0	3
VII Semester (Elective IV)						
13.	ECE741	Automotive Electronics	3	0	0	3
14.	ECE742	MEMS And Nanoelectronics	3	0	0	3
15.	ECE743	Computer Vision	3	0	0	3
16.	ECE744	Optical Fiber Communication	3	0	0	3
VII Semester (Elective V)						
17.	ECE751	Modeling and Simulation	3	0	0	3
18.	ECE752	Cryptography, Network and Cyber Security	3	0	0	3
19.	ECE753	Multimedia Communication	3	0	0	3
20.	ECE754	Advanced Embedded Systems	3	0	0	3

INTERNET OF THINGS (IoT)

Course Code: EC71 **Credits: 4:0:0**

Pre-requisites: Communication Systems **Contact Hours: 56**

Course Coordinator: Punya Prabha V

Course Content

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.

Basic Building Blocks of an IoT Device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces: Serial, SPI, I2C.

UNIT – III

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. UWB special sensors for IoT.

IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT – IV

Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Hadoop, HDFS, Mapreduce, Apache spark, Apache storm, Edge streaming, Network Analytics.

Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk, Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT – V

IoT Case Studies: Home automation: Supply of Gas and Water, Smart Meters, Smart lighting, Home intrusion detection; Smart parking environment: Weather monitoring system, Weather reporting bot, Air

Quality and monitoring pollutants, Forest fire detection, Agriculture – Smart irrigation, IoT printer, VANET.

Text Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands -on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547) Edition, McGraw Hill Education, 2017.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint).

Course Outcomes (COs):

1. Understanding the building blocks of Internet of Things, characteristics and related communication protocols. (POs- 1, 2, 5,6, 8, 10,12, PSO-3)
2. Describe the basics of design methodology, integration and applications of IoT models. (POs-1, 2, 3, 6, 8, 10, 12, PSO-3)
3. Interpret the appropriate IoT Devices and Sensors to setup the connections between them and evaluate the appropriate protocol for communication. (POs-1, 2, 3, 5, 12, PSO-3)
4. Illustrate the relationship between IoT, cloud computing, big data and introduction to IoT security. (POs-1, 2, 4, 12, PSO- 3)
5. Appraise the various IoT case studies. (POs-1, 2, 3, 4, 5, 12, PSO-3)

WIRELESS AND DATA COMMUNICATION

Course Code: EC72 **Credits: 3:1:0**

Prerequisites: Communication Systems **Contact Hours: 56**

Course Coordinator: Flory Francis

Course Content

UNIT – I

Network Models: Introduction, OSI Model Layers, TCP/IP Suite,
Data Link Control: Introduction to data link layer: Framing, flow and error control, noisy channels stop & wait ARQ, Comparison of Go- Back-N &Stop &Wait, Selective Repeat ARQ.
Multiple Access: CSMA/CD, CSMA/CA, and Channelization.

UNIT – II

Network Layer: Logical addressing IPv4: Address Space, classful Addressing, classless addressing, numerical on addressing.
IPv6 Addresses: Structure, Address Space.
Internet Protocol: IPv4 datagram format, fragmentation, numerical, transition from IPv4 toIPv6.
Delivery, Forwarding and Routing: Unicast routing Protocol: Distance Vector Routing, Dijkstra algorithms.

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, Link budget design, log- distance path loss models, log normal shadowing.
Small Scale Fading and Multipath: Small scale multipath propagation, Parameter of mobile multipath channels – Types of small scale fading.

UNIT – IV

Diversity Techniques: Polarization diversity, frequency diversity, time diversity and RAKE receiver, Space diversity – combining techniques and derivation of selection diversity improvement.
Spatial Multiplexing: Transmit diversity: 2 x 1 MISO system and 2 x 2 MIMO system example – Space Time Block Codes (STBC), Orthogonal Frequency Division Multiplexing (OFDM).

UNIT – V

Spread spectrum techniques: Pseudo-Noise Sequences, Direct Sequence Spread Spectrum(DS-SS), Frequency Hopped Spread Spectrum (FH-SS)

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

Text Books:

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

References:

1. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education, 2007.
2. James F. Kurose, Keith W. 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, 12, PSO – 3)
2. Describe transport layer formats and the network layer routing algorithms in the internet. (POs – 1, 2, 12, PSO – 3)
3. Employ cellular concept to improve capacity of cellular system with limited radio spectrum (POs – 1, 2, 12, PSO – 3)
4. Appreciate the importance of diversity technique in mobile fading channel.(POs – 1, 2, 12, PSO – 3)
5. Employ the concept of multiple access channelization techniques. (POs – 1, 2, ,12, PSO –3)

INTELLECTUAL PROPERTY RIGHTS

Course Code: EC73 **Credit: 3:0:0**

Prerequisite: Nil **Contact Hours: 42**

Course Coordinator: Roshan Zameer Ahmed

Course Content

UNIT – I

Introduction: Intro to IPR, Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications, Competing Rationales for Protection of Intellectual Property Rights, Introduction to Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization (WIPO)

UNIT – II

Patents: Introduction, Duration of patents Law and Policy Consideration, Elements of Patentability, Procedure for Filing of Patent Application (Indian & European Nations), Procedure for Opposition, Revocation of Patents, Ownership and Maintenance of Patents, Assignment and licensing of Patents, Working of Patents

UNIT – III

Trademarks: Commercial and of consumer rights, Definition and concept of Trademarks, Different kinds of Trademarks, Non Registrable Trademarks Procedure for Registration of Trademarks, Opposition Procedure, Assignment/Transmission/ Licensing of Trademarks, Infringement of Trademarks, Case Study.

UNIT – IV

Copyright: Nature of Copyright, Author & Ownership of Copyright, Transmission, Licensing of Copyrights, Infringement of Copyrights, Copyright Societies, Office, Board, Registration of Copyrights & Appeals International Conventions Copyright pertaining to Software/Internet and other Digital Media Remedies, Case Study.

UNIT – V

Future Aspects of Intellectual Property Rights: Implications on intellectual property Rights: International & National legal preparedness, Application of copyright Act 1957, Scope of protection of computer program, Applications of patents to computer technology, Competition Policy and Law,
IPRs and IPRs Policy, Framing the Competition - IPRs Relationship, Case study.

Text Books:

1. Dr. B. L. Wadhera, "Law Relating to Intellectual Property", 3rd Edition Lexis Nexis 2017.
2. Ashwani Kumar Bansal, "Law of Trademarks in India", 3rd Edition Thomson Reuters Legal Indian Publisher, 2015.
3. W.R. Cornish, "Intellectual Property", Sweet & Maxwell, London, 2018.

Course Outcomes (COs):

1. Identify the fundamentals of intellectual property rights and their significance in the field of information technology. (POs – 6, 8, PSO – 3)
2. Analyze the value of patenting and the process for acquiring a patent. (Pos – 6, 8, PSO – 3)
3. Describe the trademark registration process and conditions. (POs – 6, 8, PSO – 3)
4. Determine the concepts and methods for copyright ownership. (POs – 6, 8, PSO – 3)
5. Emphasize the importance of recent advancements in intellectual property law in the sphere of information technology. (POs – 6, 8, PSO – 3)

WIRELESS AND DATA COMMUNICATION LAB

Course Code: ECL76 **Credits: 1:0:0**

Prerequisites: Communication Systems **Contact Hours: 14**

Course Coordinator: Mamtha Mohan

Course Content

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 de-stuffing in a single frame.
3. Write a program for a HLDC frame to perform character stuffing and de-stuffing in a single frame.
4. Write a program for encryption and decryption of text.

Wireless Communication

5. Analyze the performance of Long-Distance path loss propagation model.
6. Analyze the performance of HATA propagation model.
7. Analyze the performance of CDMA channelization technique.
8. Analyze Bit Error Rate (BER) performance for BPSK signals over AWGN and Rayleigh channel. Compare the results with theoretical results.
9. Bit error rate analysis of digital communication receivers with Maximal Ratio Combining (MRC) receives diversity in frequency-flat and slowly varying fading channel. using MAT Lab
10. Bit error rate analysis of digital communication receivers with Equal Gain Combining (EGC) receives diversity in frequency-flat and slowly varying fading channel.
11. Analyze the performance of DSSS technique.
12. Measurement of numerical aperture, attenuation loss, bending loss in analog fiber optic link and data multiplexing using fiber optic link and bit rate using digital link.

Course Outcomes (COs):

1. Examine the performance of the algorithms of OSI model layers. (POs – 1, 2, 3, 5, 12, PSO–3)
2. Analyze the performance of the digital modulation receivers in AWGN and fading channel. (POs –1, 2, 3, 5, 12, PSO – 3)
3. Analyze the performance path loss in propagation models. (POs –1, 2, 3, 5, 12, PSO – 3)
4. Analyze the performance of diversity receiver in multipath fading channel. (POs – 1, 2, 3, 5, 12, PSO – 3)
5. Examine the characteristics of analog and digital optical link. (POs – 1, 2, 3, 5, 12, PSO –3)

IoT LAB

Course Code: ECL77 **Credits: 0:0:1**

Pre-requisites: Communication Systems **Contact Hours: 14**

Course Coordinator: Punya Prabha V, Manjunath C. Lakkannavar

Course Content

List of Experiments

1. Introduction to Python and Fundamentals
2. Control of LED/Buzzer with delays.
3. Interfacing IR/LDR sensor based on detection.
4. Interface Humidity sensor to print temperature and humidity readings.
5. Interface a motor relay for on/off control.
6. Interface Bluetooth to send and receive data to/from phone.
7. Interface sensor data to Thingspeak.
8. Perform basic SQL operations
9. Use UDP for client service.
10. Building Automation experiments part-1 (Demo)
11. Building Automation experiments part-2 (Demo)

Text Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands -on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547), McGraw Hill Education, 2017.
2. Python Tutorials.

Course Outcomes (COs):

1. Write programs for local processing of the sensor nodes. (POs – 1, 2, 3, 5, 9, 10, 12. PSO –3)
2. Integrate IoT devices at the edge and to the cloud. (POs – 1, 2, 3, 5, 9, 10, 12. PSO –3)
3. Analyze and process the data offline and in the cloud. (POs – 1, 2, 3, 5, 8, 9, 10, 12. PSO –3)
4. Illustrate basic SQL Operations. (POs – 1, 2, 3, 5, 8, 9, 10, 12. PSO –3)
5. Demonstration of Building Automation experiments. (POs – 1, 2, 3, 5, 8, 9, 10, 12. PSO–3)

TECHNICAL SEMINAR

Subject Code: ECS **Credits: 0:0:1**

The faculty will share one research paper relevant to his/her area of research to the student. The student has to refer to five or more papers in the same domain. The student will then present a review of the papers referred in the form a report as well as presentation.

Subject Code	Subject	No. of Hrs/Week		Duration of Exam (Hrs)	Marks		Total Marks	Credits
		Lecture	Practical/ Field Work		IA	Exam		
ECS	Technical Seminar	-	-	-	50	-	50	1

Course Outcomes (COs):

1. Identifying relevant information, defining and explaining topics under review in the selected technical paper. (POs - 1, 2, PSOs-1, 2, 3)
2. Discuss the technical details of the proposed solutions, along with advantages and disadvantages of the proposed approaches. (POs- 1, 2, 3, 4, 5 ,6, 7, PSOs- 1, 2, 3)
3. Compare the results obtained, and the improvement with respect to existing solutions. (POs- 1, 2, 3, 4, 5, 7, PSOs- 1, 2, 3)
4. Present information in a compelling, well-structured, and logical sequence, show depth of knowledge of complex subjects. (POs - 1, 2, 3, 4, 5, 7, PSOs -1, 2, 3)
5. Prepare a technical report with detailed analysis of the research domain. (POs - 10, 11, 12, PSOs- 1, 2, 3)

EVALUATION RUBRICS

Criteria	Max Marks	Achievement Levels				CO Mapping
		Inadequate (0 – 33 %)	**Developing (34-66%)**	**Proficient (67-100%)**	**Marks Awarded**	
Introduction to the area	**5**	No information about the specific technical details in the chosen area.	Some information about the area, but no clarity in internal details.	Clear presentation of the technical details, internal working, and rationale of design choices.		**CO 1,2**
Problem Statement	**10**	No clear problem identified in chosen area.	Identification of problem area, but no knowledge of underlying technical details.	Clear identification of problem area, along with parameters having an influence on the performance.		**CO 2**
Literature Survey	**15**	Very few quality sources pertinent to the chosen technical area. No recent articles used.	Ample sources from recent past, but not from quality sources or with zero or very few citations.	Ample sources from quality journals and conferences recently published, and having abundant citations.		**CO 2,3**
Presentation with depth of understanding	**10**	No clear understanding hence lack of lucid presentation.	Clear understanding of some concepts but not the whole hence presentation requires improvement.	Complete and clear understanding hence structured and clear presentation.		**CO 4**
Technical Report	**10**	Quality of report is poor.	Quality of report is average.	Quality of report is excellent.		**CO 5**
				TOTAL MARKS AWARDED		

INTERNSHIP

Course Code: ECIN **Credits: 0:0:3:0**

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 Hrs/Week		Duration of Exam (Hrs)	Marks		Total Marks	Credits
		Lecture	Practical/ Field Work		IA	Exam		
ECIN	Internship	-	-	-	50	50	100	3

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 – 1, 2, 3)
3. Appreciate the effectiveness of teamwork in completing complex tasks within deadlines. (POs – 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, PSOs – 1, 2, 3)
4. Appreciate the requirements for constant technology updation. (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 2, 3)
5. Create quality technical report describing all aspects of the internship. (POs – 1, 2, 3, 4, 5, 9, 10, 11, PSOs – 1, 2, 3)

EVALUATION RUBRICS

Criteria	Maximum Marks	Achievement Levels				CO Mapping
		Inadequate (0% – 33 %)	**Developing (34% – 66 %)**	**Proficient (67% – 100 %)**	**Marks Awarded**	
Complex Technical Blocks	**10**	No working knowledge of the domain.	Working knowledge of the domain, with some knowledge of internal details.	Detailed understanding of the system, along with underlying mechanisms.		**CO 1**
Modern Software Tools	**10**	Has not applied any modern tools for the design/analysis of the technical block diagrams.	Has applied tools, but without proper working knowledge, and has not obtained satisfactory results.	Has applied tools effectively to design/analyze/debug/optimize complex technical blocks.		**CO 2**
Teamwork	**10**	Does not understand the importance of teamwork in a practical setting.	Has utilized/partaken in team efforts to a limited extent.	Has effectively participated as a member in a team, due to which significant results have been obtained.		**CO 3**
Lifelong Learning	**10**	No understanding of the requirements for lifelong learning in the engineering profession.	Can present examples of the impact of lifelong learning in the engineering industry.	Can present examples of the impact of lifelong learning, along with the requirement of skills updation in the modern engineering profession.		**CO 4**
Report Writing	**10**	Not professionally written, content not covering all items of course outcome.	Professional report writing, with some of the course outcomes addressed as part of the report.	Professionally prepared report, addressing to full extant all the items listed as part of the required outcomes of the internship.		**CO 5**
				TOTAL MARKS AWARDED		

PROJECT

Course Code: ECP **Credits: 0:0:12:0**

The evaluation of students will be based on an intermediate presentation, along with written report containing a Certificate from the employer, If the project is carried out at Industry the rubrics for evaluation of the presentation will be distributed at the beginning of the Evaluation process

Course Code	Course Name	No. of Hrs/Week		Duration of Exam (Hrs)	Marks		Total Marks	Credits
		Lecture	Practical/ Demonstration		IA	Exam		
ECP	Project	-	-	-	50	50	100	12

Course Outcomes (COs):

1. Display an ability to undertake project activities by formulating a technical problem and testing through appropriate experiments. (POs – 1, 2, 3, 4, 9, 10,11, 12, PSO – 1, 2, 3)
2. Choose and use modern tools most suitable to the chosen technical problem. (POs –1, 2, 3, 5, 8, PSOs –1, 2, 3)
3. Analyze and evaluate technical block diagrams and propose suitable modifications to improve performance. (POs – 1, 2, 3, 4, 5, PSO –1, 2, 3)
4. Work effectively as a member or a leader of a team. (POs – 9, 10, 11, PSO – 2, 3)
5. Communicate technical content effectively through written report and oral presentations. (POs – 8, 9, 10, 11, PSOs –1, 2, 3)

	Rubrics for Evaluation (Maximum Marks = 50) Two reviews will be conducted with the same rubrics, the marks will be averaged.				**Marks Awarded**	**CO Maping**
GROUP	**Maximum Marks**	**Poor**	**Satisfactory**	**Proficient**		
Modern Tool Usage	10	Tools chosen are not appropriate for the required analysis, or are obsolete. Results are incomplete. (0 – 3)	Tools chosen are appropriate, along with the most modern version. Results are incomplete/incorrect. (4 – 7)	Tools chosen are appropriate, along with results that are matching theoretical arguments. (8 –10)		CO 1, 2, 3
Teamwork	5	No cohesive teamwork noticeable, with individuals working separately without coordination. (0 – 1)	Individuals working together, but no clear separation of tasks. (2 – 3)	Teamwork effectively used to achieve goals on schedule. (4 – 5)		CO 4
Project Management	5	No goals and/or timelines set for project. (0 – 1)	Goals and times set, but no continuous evaluation of progress. (2 – 3)	Division into timelines and intermediate goals, along with periodic reviews and observations. (4 – 5)		CO 4
Report Writing	10	Non uniform/improper formatting, details are missing, language and grammar are poor. Poor reference list. (0 – 1)	Clear formatting, but lacking detail. Grammar and writing are not suitable. Reference list is partial and not in proper format. (4 – 7)	Clear formatting, with concise and precise expression of ideas. Reference list is adequate with all details. (8 – 10)		CO 5

INDIVIDUAL Name & USN:	**Maximum Marks**	**Poor**	**Satisfactory**	**Proficient**	**Marks Awarded**	**CO Maping**
Effort & Contribution	**5**	The individual did not contribute to the project and failed to meet responsibilities. The individual does not identify key performance criteria of the system. (0 – 3)	The individual contributed modestly to the project, and is able to understand some of the design criteria in the project. (4 – 7)	The individual has contributed significantly to the project, and is informed about all the design aspects that can impact the performance. (8 – 10)		CO 4
Research/Experimentation	**10**	Is not familiar with the tools used or the technical block diagram, or the design of experiments to test hypothesis. (0 – 3)	Is familiar with the details of the technical implementation. Has used the tools, but not to their full extant. Experiments are run, but with no hypothesis testing. (4 – 7)	Is completely familiar with all elements of the technical block diagram and their functionalities. Have run experiments with an objective to testing specific hypotheses. (8 – 10)		CO 3
Demonstration/ Presentation	**5**	No eye contact, voice is low and content preparation and delivery is dry. Poor language skills. (0 – 3)	Content is well prepared but delivery is poor, language skills are inadequate. (4 – 7)	Connects with the audience with a suitably designed content and professional delivery. (8 – 10)		CO 3, 5
				TOTAL (50)		

DEPARTMENT ELECTIVES

VII SEMESTER (ELECTIVE IV)

AUTOMOTIVE ELECTRONICS

Course Code: ECE741 **Credits: 3:0:0**
Prerequisites: -- **Contact Hours: 42**
Course Coordinator: Flory Francis

Course Content

UNIT – I

Introduction to Automotive Electronics: Four Stroke Cycle, Engine Control, Ignition System, Spark Pulse Generation, Ignition Timing, Drive Train, Steering System, Battery, Starting System.

UNIT – II

Sensors: Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) sensor, Magnetic reluctance position sensor, Engine speed sensor, Ignition timing sensor, Hall effect position sensor, Knock sensor, Optical crankshaft, Manifold Absolute Pressure (MAP) sensor

UNIT – III

Vehicle Motion Control: Antilock Brake System (ABS), Electronic steering control, Power steering, Traction control, Electronically controlled suspension

Automotive Diagnostics: Engine analyzer, On-board diagnostics, Off-board diagnostics, Expert systems

UNIT – IV

Advanced Driver Assistance System: Speed sensors, Yaw rate and steering angle sensors, LIDAR, Radar, Adaptive cruise control, Introduction to autonomous vehicles

UNIT – V

Communication Systems: Basic principles and challenges of VANET, Layered architecture for VANETs, Layered architecture for DSRC communication, DSRC physical layer standard

Text Books:

1. William B. Ribbens, “Understanding Automotive Electronics”, 8th Edition, SAMS/Elsevier Publishing, 2017.
2. Hannes Hartenstein, Kenneth P Laberteaux, “VANET: Vehicular Applications and Inter-Networking Technologies”, 1st Edition, John Wiley and Sons Ltd. Publication, 2010

References:

1. Kai Borgeest, “EMC and Functional Safety of Automotive Electronics”, IET, 2018
2. Pinliang Dong, Qi Chen, “LiDAR Remote Sensing and Applications”, Taylor & Francis, 2018.

Course Outcomes (COs):

1. Appreciate fundamental systems of an automotive (POs – 1, 2, 8, 12, PSO – 2)
2. Distinguish between sensors and actuators for various applications. (POs – 1, 2, 3, 6, 7, 8, 12, PSO – 2)
3. Describe vehicle motion control and automotive diagnostics (POs –1, 2, 3, 8, 12, PSO – 2)
4. Discuss advanced driver assistance system. (POs – 1, 2, 3, 4, 6, 7, 8, 12, PSO – 2)
5. Elaborate on the principles and challenges of VANET. (POs– 1, 2, 3, 4, 6, 8, 12, PSO – 2)

MEMS AND NANOELECTRONICS

Course Code: ECE742 **Credits: 3:0:0**
Prerequisites: VLSI Design **Contact Hours: 42**
Course Coordinator: Lakshmi. S

Course Content

UNIT – I

Introduction to MEMS and MEMS devices and systems: Feynman's vision, Multi-disciplinary aspects, Application areas, Scaling laws in miniaturization

Micro and Smart Devices and Systems: Transduction principles in MEMS sensors, 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

UNIT – II

Micro-manufacturing and Packaging: Lithography, Thin-film deposition, Etching (wet and dry), Silicon micromachining: surface, bulk

Integration and Packaging of MEMS Devices: Issues, Reliability, Packaging methodology, Types of packages

UNIT – III

Electrical and Electronic Aspects of MEMS: Electrostatics, Coupled electro mechanics, Stability and pull-in phenomenon, Practical signal conditioning circuits for microsystems, RF MEMS: Switches, Varactors, Tuned filters

UNIT – IV

Introduction to Nanoelectronics: Particles and waves – Wave-particle duality, Wave mechanics, Schrödinger wave equation, Electrons in traditional low-dimensional structures, Electrons in quantum wells, Electrons in quantum wires, Electrons in quantum dots, Nanostructure devices – Resonant tunneling diodes, Single electron transfer devices

UNIT – V

Fabrication and Measurement Techniques for Nanostructures: Bulk crystal and hetero structure growth, Nanolithography

Measurement and Applications of Nano devices: Techniques for characterization of nanostructures, Injection Lasers: Quantum cascade lasers, Single photon sources, Biological tagging, Optical memories, Coulomb blockade devices, Photonic structures

Text Books:

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, "Micro and Smart Systems", 1st Edition, Wiley India, 2010.
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education India, 2009.

References:

1. T R Hsu, "MEMS and Microsystems Design and Manufacturing", 2nd Edition, Tata McGraw Hill, 2008.
2. Charles P. Poole, Jr, Frank J. Owens, "Introduction to Nanotechnology" John Wiley & Sons, Inc. 2003.

Course Outcomes (COs):

1. Analyze scaling laws and operation of various practical MEMS. (POs – 1, 2, 8, 12, PSO –2)
2. Describe various fabrication techniques and packaging methods for MEM devices. (POs –2, 3, 4, 8, 12, PSO – 2)
3. Identify electronics and RF aspects of MEMS. (POs –1, 2, 3, 4, 8, 12, PSO – 2)
4. Recognize distinguishing aspects of nanoscale devices and systems. (POs –1, 2, 3, 4, 8,12, PSO – 2)
5. Examine various design and fabrication methods of nanoscale systems and their applications. (POs –1,2, 3, 4, 8, 12, PSO – 2)

COMPUTER VISION

Course Code: ECE743 **Credits: 3:0:0**
Prerequisites: Image Processing **Contact Hours: 42**
Course Coordinator: Maya V Karki

Course Content

UNIT – I

Early Vision: Local image features, Local texture representation using filters, Pooled texture representation by discovering textons, Binocular camera geometry and epipolar constraint, Local methods for binocular fusion, Using more cameras, Application: Robot navigation, Internally calibrated perspective cameras

UNIT – II

Mid-level Vision: Segmentation by clustering**,** Human Vision: Grouping and Gestalt, Important applications, Image segmentation by clustering pixels, Segmentation, Clustering and Graphs, Image segmentation in practice

UNIT – III

Mid-level Vision: Grouping and model fitting**,** Hough transform, Fitting lines and planes, Fitting curved structures, Robustness, Fitting using probabilistic models, Motion segmentation by parameter estimation Model selection, Simple tracking strategies, Tracking using matching

UNIT – IV

High-level Vision: Registering rigid objects, Elements of differential geometry, Active range sensors, Kinect

UNIT – V

High-level Vision: Learning to classify, Classification, error and loss, Major classification strategies, Practical methods for building classifiers, Classifying images, Building good image features, Classifying images as single objects, Image classification in practice, Detecting objects in images, Sliding window method, Detecting deformable objects, Object detection, Object recognition

Text Books:

1. David A. Forsyth, Jean Ponce, "Computer Vision – A Modern Approach", 2nd edition, PHI Learning, 2015

References:

1. E. R. Davies, "Computer and Machine Vision – Theory, Algorithms and Practicalities", 5th edition, Elsevier (Academic Press), 2018
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd edition, Springer, 2021
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, analysis and Machine Vision", 4th edition, Thomson Press India Ltd., 2015.

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Appreciate the concepts of image formation and transformation techniques in computer vision (POs – 1, 2, 3, 4, 12, PSOs – 1, 3)
2. Apply various intermediate level vision-based algorithms on images (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 3)
3. Elaborate on the concept of 3-D vision and motion-based algorithms. (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 3)
4. Employ different feature extraction and motion analysis algorithms for computer vision. (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 3)
5. Analyze various classification and object detection algorithms which aid in computer vision. (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OPTICAL FIBER COMMUNICATION

Course Code: ECE744 **Credits: 3:0:0**
Prerequisites: Communication Systems **Contact Hours: 42**
Course Coordinators: M. Nagabhushanam, Mamtha Mohan

Course Content

UNIT – I

Optical Fibers: Relevance of optical communication in backhaul/backbone networks and interconnects, Fiber optics and free space optics, Optical fiber structure and parameters, Ray and mode theory of light propagation in optical fibers

UNIT – II

Transmission Characteristics: Optical signal attenuation mechanisms in guided and unguided optical signal transmissions, Optical signal distortion – Group delay, Material dispersion, Waveguide dispersion, Polarization mode dispersion, Intermodal dispersion, Profile dispersion, Fiber types, Standard single mode fibers, Dispersion shifted fibers, Dispersion flattened fibers

UNIT – III

Optical Transmitters: Materials for optical sources, Light emitting diodes, Semiconductor laser diodes, Longitudinal modes, Gain and index guiding, Power current characteristics

UNIT – IV

Optical Receivers: Principles of optical detection, Spectral responsivity, PIN, APD, Preamplifier types, Receiver noise, Signal to Noise Ratio (SNR) and Bit Error Rate (BER), Principles of coherent detection

Digital Link: Link power and rise time budget, Relevance of power and rise time budget in practical link/network planning

UNIT – V

Optical Networking: Optical amplifiers: Erbium doped fiber amplifiers, Semiconductor optical amplifiers, SONET/SDH/FDDI optical networks, WDM optical networks, Layered optical network architecture, OADM

Text Books:

1. Gerd Kaiser, "Optical Fiber Communications", 5th Edition, Tata McGraw Hill, 2013.
2. John M. Senior, "Optical Fiber Communications: Principles and Practice", 3rd Edition, Pearson Education, 2012.

References:

1. Govind P. Agrawal, "Fiber Optic Communication Systems", 3rdEdition, John Wiley & Sons, 2012.
2. Rajiv Ramasamy, Kumar N. Sivarajan, "Optical Networks: A Practical Perspective", 3rdEdition, Morgan Kauffman Publishers, 2009.

Course Outcomes (COs):

1. Appreciate the relevance of optical fibers. (POs – 1, 2, 8, 12, PSO – 3)
2. Understand the transmission characteristics of optical fibers. (POs – 1, 2, 3, 4, 6, 7, 8, 12, PSO – 3)
3. Elaborate on different types of optical transmitters characterisation (POs – 1, 2, 3, 4, 8, 12, PSO – 3)
4. Analyze the performance of optical receivers and link power budget in digital links. (POs – 1, 2, 3, 4, 8, 12, PSO – 3)
5. Acquire the knowledge on SONETS and WDM networks. (POs – 1, 2, 3, 4, 6, 7, 8, 12, PSO – 3)

VII SEMESTER (ELECTIVE V)

MODELING AND SIMULATION

Course Code: ECE751 **Credits: 3:0:0**
Prerequisites: Engineering Mathematics **Contact Hours: 42**
Course Coordinator: Mamtha Mohan, Flory Francis

Course Content

UNIT – I

Introduction to Simulation: Simulation, Advantages, Disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, Steps in a simulation study

UNIT – II

Simulation Examples: Simulation of queuing systems, Simulation of inventory systems, Other simulation examples

Queuing Models: Markov system, M/G/1 system

UNIT – III

Input Modeling: Data collection, Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time series input models

UNIT – IV

Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions, Continuous distributions, Poisson process, Empirical distributions

Verification and Validation of Model: Model building, Verification, Calibration and validation of models

UNIT – V

Output Analysis: Types of simulations with respect to output analysis, Stochastic nature of output data, Measures of performance and their estimation, Output analysis of terminating simulation, Output analysis of steady state simulations

Text Books:

1. Jerry Banks, John S Carson, Berry L Nelson, David M Nicol, "Discrete Event system Simulation", 4th Edition, Pearson Education, Asia, 2007.

References:

1. Averill M Law, W David Kelton, "Simulation Modeling & Analysis", 4th Edition, McGraw Hill International Edition, 2017.
2. Narsingh Deo, "Systems Simulation with Digital Computer", 3rd Edition, PHI Publication (EEE), 2004.

Course Outcomes (COs):

1. Understand the role of system environment (PO– 1, 2, 12, PSO – 3)
2. Apply the queuing model performance with examples (POs – 1, 2, 3, 12, PSO – 3)
3. Describe the selection of input models without data for multivariate and time series input. (POs – 1, 2, 12, PSO – 3)
4. Elaborate on the different distributions of statistical methods (POs – 1, 2, 3, 12, PSO – 3)
5. Analyze the performance of output modeling (POs – 1, 2, 3, 12, PSO – 3)

CRYPTOGRAPHY, NETWORK AND CYBER SECURITY

Course Code: ECE752 **Credits: 3:0:0**
Prerequisites: Communication Systems **Contact Hours: 42**
Course Coordinator: Chitra M

Course Content

UNIT – I

Introduction to Number Theory Principles: Introduction to cryptography, Overview of modern cryptography, Number theory principles, Euclid's algorithm

Symmetric Key Cryptography: Block cipher and DES, S-Box design principles, Block cipher modes of operation, Attacks and applications on DES

UNIT – II

Asymmetric Key Cryptography: RSA, Mathematical foundations of RSA, Attacks on RSA, Discrete Logarithm Problem (DLP), Diffie Hellman key exchange algorithm, El Gamal encryption, Theory of elliptic curves, Elliptic curve encryption and decryption

UNIT – III

Cryptographic Data Integrity Algorithms and Network Security: Applications of cryptographic hash functions, Message authentication requirements and functions, Message authentication codes, Security of hash functions and codes

UNIT – IV

System Security: Intruders, Intrusion detection, Password management, Types of malicious software, Viruses and viruses countermeasures, Need for firewalls, Firewall characteristics, Types of firewalls

UNIT – V

Cyber Security: Cyber Anti-patterns, Anti-pattern templates, forces in cyber anti-patterns, cyber anti pattern templates, 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.

Text Books:

1. W. Stallings, "Cryptography and Network Security", 7th Edition, Pearson Education, 2017.
2. Thomas J. Mowbray, "Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions", Wiley Publications, 2014.

References:

1. Behrouz A. Forouzan, "Cryptography and Network Security", 2nd Edition, TMH, 2011.
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, TMH, 2017.

Course Outcomes (COs):

1. Appreciate objectives of cryptography and network security (POs – 1, 2, 3, 4, 8, 12, PSO – 3)
2. Demonstrate the different encryption techniques, design principles and modes of operation (POs – 1, 2, 3, 4, 8, 12, PSO – 3)
3. Examine various network security algorithms (POs – 1, 2, 3, 4, 8, 12, PSO – 3)
4. Summarize techniques for system security (POs –1, 2, 3, 4, 6, 8, 12, PSO – 3)
5. Elaborate on various cyber anti-patterns and enterprise security using Zachman framework (POs – 1, 2, 3, 4, 6, 8, 12, PSO – 3)

MULTIMEDIA COMMUNICATION

Course Code: ECE753 **Credits: 3:0:0**
Prerequisites: Digital Signal Processing **Contact Hours: 42**
Course Coordinator: Maya V Karki

Course Content

UNIT – I

Introduction to Multimedia: Introduction, Network and network services, Multimedia sources, Sources and destination services, Applications of multimedia communication networks: Video streaming to multiple users, Video conferencing

Multimedia Software Tools: Multimedia presentation, Editing and authoring tools in multimedia, Graphics and image data representation, Digital video, Video display interfaces

UNIT – II

Audio and Image Coding Standards: Architectural overview of audio standards, Psychoacoustic modeling, Time frequency mapping, Quantization, Variable length coding, MPEG audio coding standards, Image compression: Quantization, Transform coding: KLT, DCT and Wavelet transforms, EZW and SPIHT algorithm, Standards: JPEG, JPEG 2000

UNIT – III

Video Compression and Standards: Basic video compression techniques, Video compression based on motion compensation, Search for motion vectors, H.261, MPEG video coding:1,2,4 and 7, Video coding standards: H.264, H.265

UNIT –IV

Network Services and Protocols for Multimedia Communication: Local area networks and access Networks, Internet technologies and protocols, Multicast extension, Quality of Service for multimedia communication, Protocols for multimedia transmission and interaction

UNIT – V

Internet Multimedia Communication: Content multimedia distribution, Broadcast multicast Video-on-demand, Peer-to-peer video streaming with mesh overlays, HTTP based media streaming, Multimedia over wireless and mobile networks: 4G cellular networks and beyond, Multimedia cloud computing

Text Books:

1. ZeNian Li, Mark S Drew, Jiangchuan Liu, “Fundamentals of Multimedia”, 2nd Edition, Springer, 2014

References:

1. Gerry D Gibson, “Multimedia Communications: Directions and Innovations”, Academic Press, 2001.
2. Ranjan Parekh, “Principles of Multimedia”, 2nd Edition Tata McGraw Hill, 2013.
3. Fred Halsall, “Multimedia Communications”, 1st Edition, Pearson Education, 2011

Course Outcomes (COs):

1. Appraise basics of multimedia communication and multimedia software tools. (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 3)
2. Illustrate different audio and image coding standards. (POs – 1, 2, 3, 4, 12, PSOs – 1, 3)
3. Elaborate on video compression based on motion compensation and MPEG video coding. (POs – 1, 2, 3, 4, 5, 12, PSOs – 1, 3)
4. Appreciate various network services and protocols for multimedia communication. (POs – 1, 2, 3, 4, 6, 12, PSOs – 1, 3)
5. Employ internet technologies for multimedia content distribution. (POs –1, 2, 3, 4, 6, 12, PSOs – 1, 3)

ADVANCED EMBEDDED SYSTEMS

Course Code: ECE754 **Credits: 3:0:0**
Prerequisites: Microcontrollers **Contact Hours: 42**
Course Coordinator: Lakshmi Shrinivasan, Suma K V

Course Content

UNIT – I

Introduction: History of embedded Linux, why embedded Linux, Embedded Linux vs Desktop Linux, Embedded Linux distributions, Porting roadmap, Getting started: Architecture of Embedded Linux, Linux kernel architecture, User space, Linux start up sequence, GNU cross platform tool chain

UNIT – II

Board Support Package (BSP): Inserting BSP in kernel build procedure, Memory map, Interrupt management, the PCI subsystem, Timers, UART and power management

UNIT – III

Embedded Storage: Flash map, Memory Technology Device (MTD), MTD architecture, Sample MTD driver for NOR flash, Flash mapping drivers, MTD block and character devices, MTD utils package, Embedded file systems, Optimizing storage space, Tuning kernel memory

UNIT – IV

Embedded Drivers: Linux serial driver, Ethernet driver, I2C subsystem on Linux, USB gadgets, Watchdog timer and kernel modules

UNIT – V

Porting Applications: Architectural comparison, Application porting roadmap, Programming with Pthreads, Operating system porting layer (OSPL), Kernel API driver

Text Book:

1. P.Raghavan, Amol Lad, SriramNeelakandan, "Embedded Linux System Design and Development", 1st Edition, Auerbach Publications, September 2019.

Reference:

2. KarimYaghmour, Jon Masters, Gilad Ben-Yossef, Philippe Gerum, "Building Embedded Linux Systems", 2nd Edition, O'Reilly Publications, 2008.

Course Outcomes (COs):

1. Employ Linux architecture in embedded systems (POs – 1, 3, 8, 12, PSO – 2)
2. Appraise the need of BSP in an embedded system (POs –1, 2, 3, 8, 12, PSO – 2)
3. Select appropriate embedded storage device (POs – 1, 2, 3, 8, 12, PSO – 2)
4. Appreciate the importance of device drivers in interfacing hardware modules (POs – 2, 3, 4, 8, 12, PSO – 2)
5. Acquire the knowledge of porting applications (POs –2, 3, 4, 8, 12 PSO – 2)