CURRICULUM

to the Academic year 2018 – 2019

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

VII & VIII Semester B. E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
BANGALORE – 54
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. All engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with faculty student ratio of 1:15 and achieves excellent academic results. The institute is a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments are full with 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 130 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 fully equipped Sports department, large air-conditioned library with over 80,000 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, all 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 45th rank in 2017 among the top 100 engineering colleges across India and occupied No. 1 position in Karnataka, among the colleges affiliated to VTU, Belagavi.

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 evolve into an autonomous institution of international standing for imparting quality technical education

Mission of the Institute

MSRIT shall deliver global quality technical education by nurturing a conducive learning environment for a better tomorrow through continuous improvement and customization

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 stakeholders concerned

Vision of the Department

To be, and be recognized as, an excellent Department in Electronics & Communication Engineering that provides a great learning experience and to be a part of an outstanding community with admirable environment.

Mission of the Department

To provide a student centered learning environment which emphasizes close faculty-student interaction and co-operative education.

To prepare graduates who excel in the engineering profession, qualified to pursue advanced degrees, and possess the technical knowledge, critical thinking skills, creativity, and ethical values.

To train the graduates for attaining leadership in developing and applying technology for the betterment of society and sustaining the world environment
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 their 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: **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 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

<table>
<thead>
<tr>
<th>Semester</th>
<th>Humanities &amp; Social Sciences (HSS)</th>
<th>Basic Sciences / Lab (BS)</th>
<th>Engineering Sciences/ Lab (ES)</th>
<th>Professional Courses - Core (Hard core, soft core, Lab) (PC-C)</th>
<th>Professional Courses - Electives (PC-E)</th>
<th>Other Electives (OE)</th>
<th>Project Work/Internship (PW/IN)</th>
<th>Extra &amp; Co-curricular activities (EAC)</th>
<th>Total Credits in a Semester</th>
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SCHEME OF TEACHING

VII SEMESTER

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<tr>
<th>Sl. No.</th>
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<th>Category</th>
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<td>EC71</td>
<td>Wireless and Data Communication</td>
<td>PS-C</td>
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VIII SEMESTER

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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


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: 2 x 1 MISO system and 2 x 2 MIMO system example – Space Time Block Codes (STBC) and spatial multiplexing, Orthogonal Frequency Division Multiplexing (OFDM)


Textbooks:


References:


Course Outcomes:

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)
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:


References:


Course Outcomes:

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


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


References:

2. LP2148 user manual.

Course Outcomes:

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 ARM7 (POs –1, 2, 3, 4, PSO – 2)
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:

References:


Course Outcomes:

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)
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:

2. LPC 2148 user manual.

Reference:

Course Outcomes:

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)
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.

<table>
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<th>Course Code</th>
<th>Course Name</th>
<th>No. of Hrs/Week</th>
<th>Duration of Exam (Hrs)</th>
<th>Marks</th>
<th>Total Marks</th>
<th>Credits</th>
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<td>-</td>
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**Course Outcomes:**

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)
## EVALUATION RUBRICS

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

Course Code: ECP

Credits: 0:0:16:0

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.

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Course Outcomes:

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, PSO – 2, 3)
3. Analyze and evaluate technical block diagrams and propose suitable modifications to improve performance. (POs – 1, 2, 3, 4, 5, PSO – 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)
Rubrics for Evaluation (Maximum Marks = 50)

Two reviews will be conducted with the same rubrics, the marks will be averaged.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Poor</th>
<th>Satisfactory</th>
<th>Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern Tool Usage</td>
<td>Tools chosen are not appropriate for the required analysis, or are obsolete. Results are incomplete. (0 – 3)</td>
<td>Tools chosen are appropriate, along with the most modern version. Results are incomplete/incorrect. (4 – 7)</td>
<td>Tools chosen are appropriate, along with results that are matching theoretical arguments. (8 – 10)</td>
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<td>(10)</td>
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<tr>
<td>Teamwork</td>
<td>No cohesive teamwork noticeable, with individuals working separately without coordination. (0 – 1)</td>
<td>Individuals working together, but no clear separation of tasks. (2 – 3)</td>
<td>Teamwork effectively used to achieve goals on schedule. (4 – 5)</td>
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<td>(5)</td>
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<tr>
<td>Project Management</td>
<td>No goals and/or timelines set for project. (0 – 1)</td>
<td>Goals and times set, but no continuous evaluation of progress. (2 – 3)</td>
<td>Division into timelines and intermediate goals, along with periodic reviews and observations. (4 – 5)</td>
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<td>(5)</td>
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<tr>
<td>Report Writing</td>
<td>Non uniform/improper formatting, details are missing.</td>
<td>Clear formatting, but lacking detail. Grammar</td>
<td>Clear formatting, with concise and precise expression of</td>
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</table>
| (10) | missing, language and grammar are poor.  
Poor reference list. (0 – 1) | and writing are not suitable.  
Reference list is partial and not in proper format. (4 – 7) | ideas. Reference list is adequate with all details. (8 – 10) |
<table>
<thead>
<tr>
<th>INDIVIDUAL</th>
<th>Poor</th>
<th>Satisfactory</th>
<th>Proficient</th>
<th>Marks Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name &amp; USN:</strong></td>
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<tr>
<td><strong>Effort &amp; Contribution</strong> (5)</td>
<td>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)</td>
<td>The individual contributed modestly to the project, and is able to understand some of the design criteria in the project. (4 – 7)</td>
<td>The individual has contributed significantly to the project, and is informed about all the design aspects that can impact the performance. (8 – 10)</td>
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</tr>
<tr>
<td><strong>Research/Experimentation</strong> (10)</td>
<td>Is not familiar with the tools used or the technical block diagram, or the design of experiments to test hypothesis. (0 – 3)</td>
<td>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)</td>
<td>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)</td>
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<tr>
<td><strong>Presentation</strong></td>
<td>No eye contact, voice is low and content preparation and delivery is poor.</td>
<td>Content is well prepared but delivery is poor.</td>
<td>Connects with the audience with a suitably designed</td>
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<td></td>
<td>delivery is dry. Poor language skills. (0 – 3)</td>
<td>language skills are inadequate. (4 – 7)</td>
<td>content and professional delivery. (8 – 10)</td>
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<td><strong>TOTAL (50)</strong></td>
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</table>

25
EXTRA AND CO-CURRICULAR ACTIVITIES

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>No. of Hrs/Week</th>
<th>Marks</th>
<th>Total Marks</th>
<th>Credits</th>
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<tr>
<td>EAC</td>
<td>Extra and Co-Curricular Activities</td>
<td>-</td>
<td>100</td>
<td>50</td>
<td>2</td>
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</tbody>
</table>

Course Outcomes:

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)
**Evaluation Rubrics – Extra/Co-Curricular Activities**

The concerned faculty will collect proof and provide marks for the activities, based on the rubrics. Marks may be added, for a total not exceeding Fifty (50) marks for Extra-Curricular activities/semester and Fifty (50) marks for Co-Curricular activities/semester.

<table>
<thead>
<tr>
<th></th>
<th>Average (0 – 25 marks/event)</th>
<th>Satisfactory (25 – 40 marks/event)</th>
<th>Good (40 – 45 marks/event)</th>
<th>Excellent (40 – 50 marks/event)</th>
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</thead>
<tbody>
<tr>
<td><strong>Organizing</strong></td>
<td>Department Level activities</td>
<td>Organized activities at the</td>
<td>Worked with professional</td>
<td>National/International</td>
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<tr>
<td></td>
<td>such as orientation, farewell,</td>
<td>college level such as robotics</td>
<td>societies (IEEE, NSS) in</td>
<td>Conferences, Meetings,</td>
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<tr>
<td></td>
<td>etc.</td>
<td>competitions, hackathons etc.</td>
<td>student/college chapter or</td>
<td>Symposia, etc., participated</td>
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<td></td>
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<td></td>
<td>individually, for organizing</td>
<td>as part of organizing</td>
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<td></td>
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<td>events inside/outside college.</td>
<td>committee.</td>
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<td>(including UDBHAV)</td>
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<tr>
<td><strong>Participating</strong></td>
<td>Attending activities</td>
<td>Participated in workshops in</td>
<td>Volunteering work with</td>
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<td></td>
<td>organized by professional</td>
<td>the domain or outside the</td>
<td>NGOs, Social Organizations,</td>
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<tr>
<td></td>
<td>societies.</td>
<td>domain, organized at a</td>
<td>Hospitals, and similar</td>
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<td></td>
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<td>prominent location/organization</td>
<td>activities undertaken for a</td>
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<td></td>
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<td>outside college.</td>
<td>period of time not lesser</td>
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<td>than one week.</td>
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<td></td>
<td>Inter-College level activities</td>
<td>Emerged victorious in inter-</td>
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<td></td>
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<td>such as quizzes, debates,</td>
<td>college/public competitions</td>
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<td>competitions, etc. in RIT or at</td>
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<td>another college.</td>
<td>hackathons, technical</td>
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<td>competitions, non-technical</td>
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<td>events such as theatre,</td>
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<tr>
<td>RIT Level</td>
<td>Sports Day participation, Udbhav participation, Technical competitions</td>
<td>Active members of societies in college such as Debate Society etc.</td>
<td>Emerged victorious in events such as sports day, quizzes/debates etc. in college level events.</td>
<td>College Team members in sports such as cricket, tennis, etc.</td>
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## LIST OF ELECTIVES

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<tr>
<th>Sl. No.</th>
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<th>Course Title</th>
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<td>ECE18</td>
<td>Internet of Things (IoT)</td>
<td>L: 3</td>
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<td>ECE19</td>
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<td>3</td>
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<td>Error Control Coding</td>
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<td>ECE22</td>
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<td>7</td>
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<td>Real Time Operating Systems (RTOS)</td>
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<td>8</td>
<td>ECE25</td>
<td>Satellite Communication and GPS</td>
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<tr>
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<td>ECE26</td>
<td>Wireless Networks</td>
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<tr>
<td>10</td>
<td>ECE27</td>
<td>Cryptography</td>
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<tr>
<td>11</td>
<td>ECE28</td>
<td>Advanced Computer Architecture</td>
<td>L: 3</td>
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<td>S: 1</td>
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</tbody>
</table>
INTERNET OF THINGS (IoT)

Subject Code: ECE18
Prerequisites: Basics of programming
Course Coordinator: Lakshmi S.

UNIT – I


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


UNIT – V


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

References:

Course Outcomes:
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
Prerequisites: Digital Signal Processing
Course Coordinator: Maya V. Karki

Credits: 3:0:0:1
Contact Hours: 42

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:

References:

1. P. P. Vaidyanathan, “Multirate systems and filter banks”, Pearson Education, Second
   Impression, 2008.
   Complex Wavelet Transform”, IEEE Signal Processing Magazine, November 2005

Course Outcomes:

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
Prerequisites: Information Theory and Coding
Course Coordinator: V. Nuthan Prasad

Credits: 3:0:0:1
Contact Hours: 42

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:


References:


Course Outcomes:

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


UNIT – IV


UNIT – V


Textbooks:

References:


Course Outcomes:

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. (PO – 1, 2, 3, PSOs – 1, 3)
OPTICAL COMMUNICATION NETWORKS

Subject Code: ECE22
Prerequisites: Digital Communication
Course Coordinator: M. Nagabushanam

Credits: 3:0:0:1
Contact Hours: 42

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, Cut off 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


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

38
Textbooks:


References:


Course Outcomes:

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
Prerequisites: Information theory and Coding
Course Coordinator: Maya V Karki

Credits: 3:0:0:1
Contact Hours: 42

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
References:


Course Outcomes:

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


UNIT – II

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


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

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:


Reference:


Course Outcomes:

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
Prerequisite: Microwave Devices and Radar
Course Coordinator: Akkamahadevi M B

Credits: 3:0:0:1
Contact Hours: 42

UNIT – I


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 & Intermodulation 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.

Textbooks:


References:


Course Outcomes:

1. Identify the significance of Kepler’s laws of orbital mechanism and perturbations. (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)
UNIT – I


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


UNIT – IV


UNIT – V


Textbooks:


References:


Course Outcomes:

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. (PO – 1, 6, 7, PSO – 3)
5. Outline the Routing Protocols for Ad Hoc Wireless Networks. (PO – 1, 6, 7, PSO – 3)
CRYPTOGRAPHY

Subject Code: ECE27
Prerequisites: Digital Communication
Course Coordinator: Shreedarshan K

Credits: 3:0:0:1
Contact Hours: 42

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


UNIT – V


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:


References:


Course Outcomes:

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, Multivectors 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.


UNIT – III

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


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 (U1), Control flow versus data flow, Comparisons of flow mechanisms, Performance Metrics and Measures (U2), Advanced processor technology, Instruction-set Architectures
(U3), Cache basics & cache performance, reducing miss rate and miss penalty (U4), cache coherence protocols (MSI, MESI, MOESI), overview of directory based approaches (U5)

**Textbook:**


**References:**


**Course Outcomes:**

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)