KARNATAK LAW SOCIETY’S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Institution under Visvesvaraya Technological University, Belagavi)

**(APPROVED BY AICTE, NEW DELHI)**

**Department of Electronics and Communication Engineering**

**Scheme and Syllabus** (2016 Scheme)

**7th and 8th Semester** B.E.

|  |
| --- |
| **INSTITUTION VISION** |
| Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills. |

|  |
| --- |
| **MISSION** |
| To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset. |

|  |
| --- |
| **QUALITY POLICY** |
| * Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment. * Fostering cultural, ethical, moral and social values in the human resources of the institution. * Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education. |

|  |
| --- |
| **DEPARTMENT VISION** |
| The Electronics & Communication Engineering department shall impart quality technical education and entrepreneurship skills to develop creative individuals to face changing global scenario. |

|  |
| --- |
| **DEPARTMENT MISSION** |
| To augment the national talent pool, with Electronics and Communication Engineers having all-encompassing technical knowledge, principled practices and nationalistic outlook. |

|  |  |
| --- | --- |
| **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)** | |
| 1. | The graduates will acquire core competence in basic science and Electronics and Communication Engineering fundamentals necessary to formulate, analyze, and solve engineering problems and to pursue advanced study or research. |
| 2. | The graduates will engage in the activities that demonstrate desire for ongoing personal and professional growth and self-confidence to adapt to rapid and major changes. |
| 3. | The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills, work as part of teams on multidisciplinary projects under diverse professional environments, and relate engineering issues to the society, global economy and to emerging technologies. |

|  |  |
| --- | --- |
| **PROGRAM OUTCOMES (POs)** | |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. |
| 4. | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. |
| 5. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. |
| 6. | **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. |
| 7. | **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development. |
| 8. | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. |
| 9. | **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. |
| 10. | **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. |
| 11. | **Project Management and Finance:** Demonstrate knowledge and understanding of 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. |
| 12. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. |

|  |  |
| --- | --- |
| **PROGRAM SPECIFIC OUTCOMES (PSOs)** | |
| 1. | Understanding and applying the mathematical and scientific concepts, for analysis and design of basic Electronics and Communication systems. |
| 2. | Developing critical thinking abilities coupled with competence in use of computational tools for professional growth; complimented with communication skills and leadership attributes. |
| 3. | Identifying societal needs and sensitizing individuals towards finding innovative solutions to contemporary issues with multidisciplinary outlook. |

**Scheme of Teaching**

**Semester VII**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Code** | **Course** | | **Contact Hours** | **Total credits** | **Contact Hours/ week** | **Marks** | | |
| **L – T - P** | **CIE** | **SEE** | **Total** |
| 1. | 16EC71 | Computer Communication Networks | PC1 | 4 – 0 – 0 | 3 | 4 | 50 | 50 | 100 |
| 2. | 16EC72 | Wireless and Mobile Communication | PC2 | 4 – 0 – 0 | 3 | 4 | 50 | 50 | 100 |
| 3. | 16EC73 | GPS and IoT | PC3 | 3 – 0 – 2 | 4 | 5 | 50 | 50 | 100 |
| 4. | 16EC74 | Optical Fiber Communication | PC4 | 3 – 0– 2 | 4 | 5 | 50 | 50 | 100 |
| 5. | 16EC75x | Elective –II | PE – II | 3 – 0 – 2 | 3 | 5 | 50 | 50 | 100 |
| 6. | 16EC76x | Elective – III | PE – III | 3 – 0 – 2 | 3 | 5 | 50 | 50 | 100 |
| 7. | 16ECL77 | Communication and Networking Lab | L1 | 0 – 0 – 3 | 2 | 3 | 25 | 25 | 50 |
| 8. | 16ECL78 | Wireless and Mobile Communication Lab | L2 | 0 – 0 – 3 | 2 | 3 | 25 | 25 | 50 |
| 9. | 16EC79 | **#**Seminar on Project synopsis | PC | 0 – 0 – 2 | 2 | 2 | 25 | 0 | 25 |
|  |  | **Total** | | **20 – 0 – 16** | **26** | **36** | **375** | **350** | **725** |

**#** Project batches and guide allocation to be done before the end of sixth sem.

|  |  |
| --- | --- |
| **Course Code** | **Elective – II** |
| 16EC751 | Electronic System Design |
| 16EC752 | Satellite Communication |
| 16EC753 | ASIC Design |
| 16EC754 | Data Base Management System |

|  |  |
| --- | --- |
| **Course Code** | **Elective – III** |
| 16EC761 | Low Power VLSI |
| 16EC762 | Ad Hoc and Sensor Networks |
| 16EC763 | Real Time OS |
| 16EC764 | Multimedia Communication |

**Scheme of Teaching**

**Semester VIII**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Code** | **Course** | | **Contact Hours** | **Total credits** | **Contact Hours/ week** | **Marks** | | |
| **L – T - P** | **CIE** | **SEE** | **Total** |
| 1. | 16EC81 | Internship |  |  | 2 | 2 | 50 | 0 | 50 |
| 2. | 16EC82 | Intellectual Property Right and Cyber law | SS | Self Study | 2 | 2 | 50 | 0 | 50 |
| 3. | 16EC83 | Professional Certification - 1 |  |  | 0 | 1 | 25 | 0 | 25 |
| 4. | 16EC84 | Professional Certification - 2 |  |  | 0 | 1 | 25 | 0 | 25 |
| 5. | 16EC85 | Minor Project on Social Responsibility | HS | 0 – 0 – 2 | 2 | 1 | 25 | 0 | 25 |
| 6. | 16EC86 | Project Phase -1 | PC |  | 2 | 2 | 50(25+25) | 0 | 50 |
| 7. | 16EC87 | Project Phase -2 | PC |  | 2 | 4 | 50(25+25) | 0 | 50 |
| 8. | 16EC88 | Project Phase-3 (Final Viva Voce) |  | Final | 2 | 7 | 0 | 100 | 100 |
|  |  | **Total** | | **0 – 0 – 2** | **12** | **20** | **275** | **100** | **375** |

Project Phase -1 and 2: CIE- 50 marks (25 marks –Internal guide + 25 marks - presentation)

Intellectual Property Right and Cyber law: Syllabus will be provided. CIE marks will be based on the IA tests.

|  |
| --- |
| **Computer Communication Networks** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC71 | **Credits** | 3 |
| **Course type** | PC1 | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 4 – 0 – 0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |  |
| --- | --- | --- |
| **Course Learning Objectives (CLOs)** | | |
| 1. | To study the OSI model, Layers in OSI &Internet Architecture. |
| 2. | To comprehend the different flow and multiple access techniques and protocols. |
| 3. | To study and compare different IEEE standards for wired and wireless LAN’s. |
| 4. | To get familiar with networking devices and IPv4 and IPv6 addressing schemes. |
| 5. | To gain knowledge about routing, forwarding of data and DNS. |

|  |  |
| --- | --- |
| **Unit – I** | **8 Hours** |
| **Introduction:** Data Communications, Networks, Internet, Protocols and Standards, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing. | |

|  |  |
| --- | --- |
| **Unit – II** | **8 Hours** |
| **Data Link Control:** Framing, Flow and error control Protocols, Noiseless channels and noisy channels, HDLC, Multiple Access: Random access, Controlled access, Channelization. | |

|  |  |
| --- | --- |
| **Unit – III** | **8 Hours** |
| Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| Connecting devices, Back bone Networks, Virtual LANs, **Network Layer**: Logical addressing, Ipv4 addresses, Ipv6 addresses. | |

|  |  |
| --- | --- |
| **Unit –V** | **8 Hours** |
| Unicast Routing Protocols, Multicast Routing protocols. Transport layer Process to process Delivery, UDP, TCP, Domain name system, Resolution. | |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Behrouz A Forouzan, “Data Communication and Networking”, Tata McGraw-Hillblishing Company Limited, Indian Edition, 2006 and onwards. |
| **Reference Books** | |
| 1. | Larry L. Peterson and Bruce S. Devie, Computer Networks, Morgan Kaufmann Publications, 5th Edition and onwards. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Compare and contrast the OSI and TCP/IP architecture suite. | L5 |
| 2. | Apply knowledge of Flow control in general to data networks. | L3 |
| 3. | Understand the significance of standards in the networking industry and analyze wired and wireless LAN architectures. | L2 |
| 4. | Design networks using the knowledge of IPV4 and IPV6 addressing. | L6 |
| 5. | Compare the different Routing and Forwarding protocols and structure of the DNS. | L5 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems | 1 |
| 2. | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | 4 |
| 3. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | 5 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | **Assessment methods** | |
| 1. | Classroom Teaching (Blackboard) | 1. | IA test |
| 2. | Presentation | 2. | Assignment |
| 3. | Video presentations | 3. | Quiz |
|  |  | 4. | Activity |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

**Wireless and Mobile Communication**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code-** | 16EC72 | **Credits** | 4 |
| **Course type-** | PC2 | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 4 – 0 – 0 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To enable the student to understand the various generations of wireless communications and different components of cellular communication. |
| 2. | To enable the student to understand the different techniques of cellular communication. |
| 3. | To enable the student to understand the network architecture and operations of cellular wireless network. |
| 4. | To enable the student to understand channel concept and call establishment in GSM and TDMA  Techniques. |
| 5. | To enable the student to understand channel concept and call establishment in CDMA  Technique. |

|  |
| --- |
| **Pre-requisites:** Basics of electronic Communication. |

|  |  |
| --- | --- |
| **Unit – I** | **8 Hours** |
| **Introduction to wireless telecommunication systems and Networks:** History and Evolution of wireless cellular network, Different generations of wireless cellular networks, 1G, 2G, 3G , 4G and 5G networks. | |

|  |  |
| --- | --- |
| **Unit – II** | **8 Hours** |
| **Common Cellular System:** Common Cellular network components, Hardware and software views of cellular networks, 3G cellular systems components, Cellular component identification, Call establishment. | |

|  |  |
| --- | --- |
| **Unit – III** | **8 Hours** |
| **Wireless network architecture and operation:** Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backhaul networks, Mobility management. Radio Resource and Power Management, Wireless network security. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **GSM & TDMA Technology:** GSM system overview, GSM Network and System Architecture, GSM channel concepts, TDMA Frames. GSM System Operations (Traffic cases) | |

|  |  |
| --- | --- |
| **Unit –V** | **8 Hours** |
| **CDMA Technology:** CDMA System overview, Introduction to CDMA, CDMA network and stsyem architecture, CDMA channel concept. | |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Mullet, “Wireless Telecom: Systems and networks”, Thomson Learning, 2006 and onwards. |
| 2. | S. S. Manvi, M. S. Kakkasageri, “Wireless and Mobile Network concepts and protocols”, John Wiley India Pvt. Ltd, 1st Edition, 2010 and onwards. |
| **Reference Books** | |
| 1. | Lee W.C.Y, “Mobile Cellular Telecommunication”, MGH, 2nd Edition, 2009 and onwards. |
| 2. | D P Agrawal, “Wireless communication, 2nd Edition, Thomson learning 2007 and onwards. |
| 3. | David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge 2005  and onwards. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Identify and describe different generations of wireless communication. | L1, L2 |
| 2. | Analyze the different Techniques of cellular communication. | L4 |
| 3. | Describe the network operations of cellular network component. | L2 |
| 4. | Analyze and Compare different channel concepts in GSM and TDMA. | L4 & L5 |
| 5. | Analyze the different channel concepts in CDMA. | L4 |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | 4 |
| 3. | **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development. | 7 |
| 4. | **Project Management and Finance:** Demonstrate knowledge and understanding of 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. | 11 |
| 5. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | 12 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | **Assessment methods** | |
| 1. | Classroom Teaching (Blackboard) | 1. | IA test |
| 2. | Presentation | 2. | Assignment |
| 3. | Videos | 3. | Quiz |
| 4. | Notes | 4. | Mini Project |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE :Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

**GPS and IoT**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC73 | **Credits** | 4 |
| **Course type** | PC3 | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To introduce to the basics of Global Positioning System. |
| 2. | To explore various positioning modes in GPS. |
| 3. | To study ambiguity resolution techniques. |
| 4. | To introduce the concepts of internet of things. |
| 5. | To explore the applications of IoT. |

|  |  |
| --- | --- |
| **Unit – I** | **8 Hours** |
| **Introduction to GPS:** Historical Review, Overview of GPS, GPS Segments, GPS Satellite Generations, Current GPS Constellation, Control Sites, GPS: the Basic Idea, GPS Positioning Service, Why Use GPS?  **GPS Details:** GPS Signal Structure, GPS Modernization, Types of GPS Receivers, Time Systems, Pseudorange Measurements, Carrier-Phase Measurements, Doppler Measurements, Cycle Slips, Linear Combinations of GPS Observables. | |
| **List of Experiments:**  1. With the help of a hand-held GPS, determine Planimetric coordinates and elevations of various points.  2. Create Routes in a GPS receiver: Datums, Entering coordinates, Making a route. | |

|  |  |
| --- | --- |
| **Unit – II** | **8 Hours** |
| **GPS Errors and Biases:** GPS Ephemeris Errors, Selective Availability, Satellite and Receiver Clock Errors, Hardware Delay, Multipath Error, Antenna Phase Center Variations, Receiver Measurements Noise, Ionospheric Delay, Tropospheric Delay, Satellite Geometry Measures, GPS Mission Planning, User Equivalent Range Error.  **GPS Positioning Modes:** GPS Point Positioning, Precise Point Positioning, GPS Relative Positioning, Static GPS Surveying, Fast (Rapid) Static, Stop & Go GPS Surveying, RTK GPS, Real-Time Differential GPS, Real-Time vs. Post processing, Communication (Radio) Link. | |
| **List of Experiments:**  1. Navigation using a GPS receiver: Compass function, Route, Tracks, Backtracking.  2. Making maps: Plotting points collected from the GPS receiver, Data transfer. | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Unit –III** | | | **8 Hours** | | |
| **Ambiguity Resolution Techniques:** Antenna Swap Method. On-the-Fly Ambiguity Resolution, The LAMBDA Method, GPS Data and Correction Services – GPS Data Service, Precise GPS Orbit and Clock Service, DGPS Radio Beacon Systems, Wide-Area DGPS Service, Wide Area Augmentation System (WAAS), European Geostationary Navigation Overlay System (EGNOS), Multi-site Real-Time Kinematic (RTK) System. | | | | | |
| **List of Experiments:**  1. Google Earth (GE) and Online Data: Navigating in GE, Using GE to obtain coordinates, Other data sources (eg. USGS). | | | | | |
| **Unit –IV** | | **8 Hours** | | |
| **The Third ICT Wave:** Rise of the machines, The IoT Kaleidoscope, Defining Internet of Things, IoT: A Web 3.0 View.  **Ubiquitous IoT Applications:** A Panoramic View of IoT Applications, Important Vertical IoT Applications.   |  |  | | --- | --- | | **Unit - V** | **8 Hours** | | **Four Pillars of IoT:** The Horizontal, Verticals, and Four Pillars, M2M: The Internet of Devices, RFID: The Internet of Objects, WSN: The Internet of Transducers, SCADA: The Internet of Controllers.  **The DNA of IoT: DCM:** DCM: Device, Connect, and Manage, Device: Things That Talk, Connect: Via Pervasive Networks (Wired Networks, Wireless Networks, Satellite IoT), Manage: To Create New Business Value. | | | **List of Experiments:**  1. Start Raspberry Pi and try various Linux commands in command terminal window.  2. Run some python programs on Pi.  3. Implement an intruder system that sends an alert to the given email.  4. Get the status of a bulb at a remote place (on the LAN) through web. | | | | | | |
|  | | |  | | |
|  | | | | | |
|  | | | | | |
| **Books** | | | |
| 1. | Ahmed El-Rabbany, “Introduction to GPS”, Artech House. | | |
| 2. | G S Rao, “Global Navigation Satellite Systems: With Essentials of satellite communications”, TMH. | | |
| 3. | Honbo Zhou, “The Internet of Things in the Cloud”. | | |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Explain the concepts of global positioning system. | L2 |
| 2. | Enumerate various GPS ambiguity resolution techniques. | L3 |
| 3. | Analyze navigation techniques to obtain geographical coordinates. | L2, L4 |
| 4. | Understand the basic concepts of internet of things in modern world applications. | L2 |
| 5. | To implement the concepts of GPS and IoT to solve real life problems | L6 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | 2 |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | 3 |
| 4. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | 5 |
| 5. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | 12 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | **Assessment methods** | |
| 1. | Blackboard Teaching | 1. | Internal Assessment |
| 2. | PPT’s | 2. | Quiz |
| 3. | Videos | 3. | Assignment |
|  |  | 4. | Activity |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

**Optical Fiber Communication**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC74 | **Credits** | 4 |
| **Course type** | PC4 | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures. |
| 2. | To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length. |
| 3. | To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers. |
| 4. | To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration. |
| 5. | To learn fiber splicing and connectors, noise effects on system performance, operational principles WDM and solutions. |

|  |  |
| --- | --- |
| **Unit –I** | **8 Hours** |
| **Introduction to Optical Fibers:** Evolution of fiber optic system, Element of an Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Wave guides, Overview of Modes-Key Modal concepts, Linearly Polarized Modes, Single Mode Fibers-Graded Index fiber structure. | |
| **Lab Experiments:**   1. Measurement of Numerical Aperture. 2. Measurement of Power Launching into the Fiber. | |

|  |  |
| --- | --- |
| **Unit –II** | **8 Hours** |
| **Signal Degradation Optical Fibers:** Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength. | |
| **Lab Experiments:**   1. Measurement of Spectral Attenuation. 2. Measurement of Fiber Loss. | |

|  |  |
| --- | --- |
| **Unit –III** | **8 Hours** |
| **Fiber Optical Sources and Coupling:** Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, lasers Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber -to- Fiber joints, Fiber splicing. | |
| **Lab Experiments:**   1. Setting up an Analog Fiber link for Optical Fiber System. 2. Characterization of Sources for Optical Fiber Systems. | |

|  |  |
| --- | --- |
| **Unit –IV** | **8 Hours** |
| **Fiber Optical Receivers:** PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, Preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit. | |
| **Lab Experiments:**   1. Characterization of Detectors for Optical Fiber Systems. 2. Wavelength Multiplexing in an Optical Fiber. | |

|  |  |
| --- | --- |
| **Unit –V** | **8 Hours** |
| **Digital Transmission System:** Point-to-Point links System considerations, Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM, Solitons-Erbium-doped Amplifiers, Basic on concepts of SONET/SDH Network. | |
| **Self study topics:** Analog Transmission System, Wavelength Division Multiplexing**.** | |
| **Lab Experiments:**   1. Optical Link Design. 2. An Optical Fiber Acoustic Sensor. | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Text Books** | | | | | | | | |
| 1. | Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd Edition, 2000 and onwards. | | | | | | | |
|  | **Reference Books** | | | | | | | |
| 1. | J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994 and onwards. | | | | | | | |
| 2. | J.Gower, "Optical Communication System", Prentice Hall of India, 2001 and onwards. | | | | | | | |
| **Course Outcome (COs)** | | | | | | | | |
| At the end of the course, the student will be able to | | | | | | | Bloom’s Level | |
| 1. | | Recognize and classify the structures of Optical fiber and types. | | | | | L2 | |
| 2. | | Discuss the channel impairments like losses and dispersion. | | | | | L2 | |
| 3. | | Analyze various coupling losses. | | | | | L4 | |
| 4. | | Classify the Optical sources and detectors and to discuss their principle. | | | | | L4, L5 | |
| 5. | | Familiar with Design considerations of fiber optic systems. | | | | | L1 | |
| 6. | | To perform characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyze the results to provide valid conclusions. | | | | | L5, L6 | |
| **Program Outcome of this course (POs)** | | | | | | **PO No.** | |
| 1. | | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | | | | 1 | |
| 2. | | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | | | | 2 | |
| 3. | | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations | | | | 3 | |
| 4. | | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | | | | 4 | |
| 5. | | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | | | | 5 | |
| 6. | | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | | | | 12 | |
| **Course delivery methods** | | | | **Assessment methods** | | | | | |
| 1. | | | Blackboard Teaching | 1. | Internal Assessment | | | | |
| 2. | | | PPT’s | 2. | Quiz | | | | |
| 3. | | | Videos | 3. | Assignment | | | | |
|  | | |  | 4. | Activity | | | | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

**Elective – II: Electronic System Design**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC751 | **Credits** | 3 |
| **Course type** | PE –II | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | Understand the importance of SystemC in designing a system. |
| 2. | Understand the modeling of systems above the Register transfer Level of abstraction. |
| 3. | Understand functional modeling and requirement of intellectual property. |
| 4. | To understand the need of communication and synchronization in systems through interfaces and channels. |
| 5. | Understanding the process of refinement and the need for testing and debugging the system. |

|  |
| --- |
| **Pre-requisites :**  1. Computer Organization and Architecture (16EC41).  2. Computer Programming in C (16CCP14/24). |

|  |  |
| --- | --- |
| **Unit –I** | **8 Hours** |
| **Fundamentals of SystemC:** Modules, Interfaces, Ports and channels, Processes, Events, Sensitivity, Event finder, Module and channel instantiation. | |

|  |  |
| --- | --- |
| **Unit –II** | **8 Hours** |
| **Models of Computation:** Introduction, RTL model of computation, Kahn process networks, Static dataflow, Transaction-Level models.  **Classical Hardware modeling with SystemC**: Introduction, Register transfer level modeling, Behavioral-level modeling, Hardware oriented data types. | |

|  |  |
| --- | --- |
| **Unit –III** | **8 Hours** |
| **Functional Modeling:** Untimed functional models – dataflow, Timed functional model, Stopping a dataflow simulation.  **Parameterized Modules and Channels:** Introduction, Forms of parameterization, Parameterized design examples, Protecting intellectual property. | |

|  |  |
| --- | --- |
| **Unit –IV** | **8 Hours** |
| **Interface and Channel Design:** Introduction, Interface design, Primitive versus hierarchical channels, Primitive channel examples, Hierarchical channel examples. | |

|  |  |
| --- | --- |
| **Unit –V** | **8 Hours** |
| **Communication Refinement:** Steps in refinement process, Hardware-hardware communication refinement, Software-software communication refinement.  **Test benches, Tracing and Debugging:** Introduction, Test benches, Tracing, Debugging. | |
| **Self learning topics:**  Hardware-software communication interface. | |

**Lab Experiments:**

**All experiments to be conducted using SystemC**

1. Combinational logic modeling.
2. Sequential logic modeling.
3. Memories in SystemC.
4. FSM design.
5. Hierarchical channels.
6. Implementation of stack.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Text Books** | | | | |
| 1. | Grötker, T., Liao, S., Martin, G., Swan, S, “System Design with SystemC”, Springer, 2002 and onwards. | | | |
| 2. | Sandro Rigo, Rodolfo Azevedo and Luiz Santos, “Electronic System Level Design”, Springer, 2011 and onwards. | | | |
| **Course Outcome (COs)** | | | | |
| At the end of the course, the student will be able to | | | Bloom’s Level | |
| 1. | | Recognize the need of SystemC in designing a system. | L2 | |
| 2. | | Examine the modeling of electronic system at the register level. | L3 | |
| 3. | | Evaluate a system and asses the need for intellectual property. | L4 | |
| 4. | | Explain the communication and synchronization in electronic systems. | L1 | |
| 5. | | Test the designed system and validate it based on the requirements specified. | L5, L6 | |
| **Program Outcome of this course (POs)** | | | | **PO No.** |
| 1. | | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems | | 1 |
| 2. | | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations  . | | 5 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | **Assessment methods** | |
| 1. | Blackboard Teaching | 1. | Internal Assessment |
| 2. | PPT’s | 2. | Quiz |
| 3. | Videos | 3. | Assignment |
| 4. | Demonstration | 4. | Activity |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – II: Satellite Communication** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC752 | **Credits** | 3 |
| **Course type** | PE – II | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To understand the basic concept in the field of Satellite Communication and to know how to place a satellite in an orbit. |
| 2. | To study the propagation impairments and Space link. |
| 3. | To get a complete knowledge about the earth and space segments. |
| 4. | To understand the variety of multiple access techniques. |
| 5. | To gain knowledge about the Satellite system and mobile services provided. |

|  |
| --- |
| **Pre-requisites :**  1. Communication Theory and Techniques (16EC45).  2. Fields and Waves (16EC44).  3. Digital Communication (16EC51). |

|  |  |
| --- | --- |
| **Unit - I** | **8 Hours** |
| **Overview of Satellite Systems:** Introduction, Frequency allocation for satellite services, INTELSAT, Polar orbiting satellites, Argos system.  **Satellite Orbits**: Introduction, Kepler’s Laws, Definitions of terms for earth orbiting satellites, Orbital elements, Apogee and Perigee heights, Orbital Perturbations, Inclined Orbits, Geostationary orbits, Solar time and sun synchronous orbits. | |
| **Lab Experiments Using MATLAB:**  1. Compute orbital period of Satellite.  2. Compute true anomaly for given altitude.  3. Compute radial and tangential velocity components of satellite.  4. Compute velocities at Apogee and Perigee.  5. Compute eccentricity of satellite orbit.  6. Illustration of Kepler’s Laws.  7. Sun-synchronous Orbit Design.  8. Compute Local Side Real Time. | |

|  |  |
| --- | --- |
| **Unit - II** | **8 Hours** |
| **Propagation Impairments& Polarization:** Introduction, Atmospheric losses, Ionospheric effects, Rain attenuation, Antenna polarization, Polarization of satellite signals, Discrimination, Ionospheric depolarization, Rain depolarization, Ice depolarization.  **Space Link:** Introduction, Equivalent Isotropic Radiated Power (EIRP), Transmission losses, Link power budget equation, System noise, CNR, Uplink, Down link, Effects of rain, Combined uplink and downlink CNR. | |
| **Self learning topics:** Cross polarization. | |
| **Lab Experiments Using MATLAB:**  1. Simulation of satellite link budget analysis. | |

|  |  |
| --- | --- |
| **Unit - III** | **8 Hours** |
| **Space Segment:** Introduction, Power supply units, Attitude control, Station keeping, Thermal control, TT&C subsystems, Transponders, Antenna subsystem.  **Earth Segment:** Introduction, Receive only home TV system, Master antenna TV system, Transmit-Receive earth stations. | |
| **Self learning topics:** Community Antenna TV system. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **Interference:** Introduction, Interference between satellite circuits, Downlink, Uplink, Combined [C/I] due to interference on both uplink and downlink, Antenna gain function, Pass band interference, Receiver transfer characteristic, Energy dispersal.  **Satellite Access**: Introduction, Single access, Pre-assigned FDMA, Demand-assigned FDMA, Spade system, TDMA, Pre-assigned TDMA, Demand assigned TDMA, Down link analysis for digital transmission, Comparison of uplink power requirements for TDMA & FDMA, Satellite switched TDMA, On-board signal processing for FDMA/TDM operation. | |

|  |  |
| --- | --- |
| **Unit - V** | **8 Hours** |
| **DBS Television**: Introduction, Orbital spacing, Power rating and number of transponders, HDTV, Frequencies and polarization, Transponder capacity, Bit rates for Digital Television, The Home Receiver Outdoor Unit (ODU), The Home Receiver Indoor Unit (IDU).  **Satellite Mobile and Specialized Services**: Introduction, Satellite mobile services, VSATs, Radarsat, Global Positioning System, Orbcomm, Iridium. | |
| **Lab Experiments Using MATLAB**  1. Satellite image enhancement. | |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Dennis Roddy, “Satellite Communications”, 4th Edition, McGraw-Hill International Edition, 2006 and onwards. |
| 2. | Timothy Pratt, Charles Bostian and Jeremy Allnutt, “Satellite Communications”, 2nd Edition, John Wiley Pvt. Ltd & Sons, 2008 and onwards. |
| **Reference Books** | |
| 1. | W. L. Pitchand, H. L. Suyderhoud and R. A. Nelson, “Satellite Communication Systems Engineering”, 2nd Edition, Pearson Education, 2007 and onwards. |
| 2. | J. Martin, “Communication satellite Systems”, PHI publication, 2001 and onwards. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Describe the frequency allocation and types of satellite systems. | L2 |
| 2. | Understand modulation and coding schemes in satellite communication systems using principles and techniques developed throughout the course. | L2 |
| 3. | Illustrate the orbital determination and launching methods. | L3 |
| 4. | Describe multiple access techniques like TDMA, CDMA, FDMA. | L2 |
| 5. | Demonstrate the impacts of GPS, Navigation. | L3 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems | 1 |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | 2 |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | | **Assessment methods** |
| 1. Black board teaching | 1. | Assignments | |
| 1. PPT | 2. | CIE | |
| 1. Video | 3. | Quiz | |
| 1. Animation |  |  | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – II: ASIC Design** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC753 | **Credits** | 3 |
| **Course type** | PE – II | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | Explain ASIC methodologies and programmable logic cells to implement a function on IC. |
| 2. | Analyse back-end physical design flow, including partitioning, floor-planning, placement and routing. |
| 3. | Gain sufficient theoretical knowledge for carrying out FPGA and ASIC designs. |
| 4. | Design CAD algorithms and explain how these concepts interact in ASIC. |
|  |  |

|  |
| --- |
| **Pre-requisites :**  1. CMOS VLSI Design (16EC54). |

|  |  |
| --- | --- |
| **Unit - I** | **8 Hours** |
| **Introduction to ASICs**, Full custom, Semi-custom and Programmable ASICs, ASIC Design flow, ASIC cell libraries. **CMOS Logic:** Datapath Logic Cells**:** Data Path Elements, Adders: Carry skip, Carry bypass, Carry save, Carry select, Conditional sum, Multiplier (Booth encoding), Data path Operators, I/O cells. | |
| **Lab Experiments:**  1. Realization of Data Path Elements like Adders. | |

|  |  |
| --- | --- |
| **Unit - II** | **8 Hours** |
| **ASIC Library Design:** Logical effort: Predicting Delay, Logical area and logical efficiency, Logical paths, Multi stage cells, Optimum delay and number of stages.  **Programmable ASIC Logic Cells:** MUX as Boolean function generators, Actel ACT: ACT 1, ACT 2 and ACT 3 Logic Modules, Xilinx LCA: XC3000 CLB, Altera FLEX and MAX. | |
| **Lab Experiments:**  1. Analysis of Logical effort: Predicting Delay, Logical area and logical efficiency for a given circuit. | |

|  |  |
| --- | --- |
| **Unit – III** | **8 Hours** |
| **Programmable ASIC I/O Cells:** Xilinx and Altera I/O Block. **Low-level design entry:** Schematic entry: Hierarchical design, Netlist screener. **ASIC Construction:** Physical Design, CAD Tools.  **Partitioning:** Goals and objectives, Constructive Partitioning, Iterative Partitioning Improvement, KL, FM and Look Ahead algorithms. | |
| **Lab Experiments:**  1. Realization of Partitioning algorithms (K-L algorithm). | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **Floor planning and placement:** Goals and objectives, Floorplanning tools, Channel definition, I/O and Power planning and Clock planning, Placement**:** Goals and Objectives, Min-cut Placement algorithm, Iterative Placement Improvement, Physical Design Flow. | |
| **Lab Experiments:**  1. Introduction of SPICE and Abel Hardware Description Languages (HDL). | |

|  |  |
| --- | --- |
| **Unit - V** | **8 Hours** |
| **Routing:** Global Routing: Goals and objectives, Global Routing Methods, Back-annotation. Detailed Routing: Goals and objectives, Measurement of Channel Density, Left-Edge And Area-Routing Algorithms, Special Routing, Circuit extraction and DRC. | |
| **Lab Experiments:**  1. Design and simulation of routing algorithms. | |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Michael John Sebastian Smith, “Application - Specific Integrated Circuits” Addison Wesley Professional; 2005 and onwards. |
| 2. | 1. Neil H.E. Weste, David Harris, and Ayan Banerjee, “CMOS VLSI Design: A Circuits and Systems Perspective”, 3rd Edition, Addison Wesley/ Pearson education, 2011 and onwards. |
| **Reference Books** | |
| 1. | Rakesh Chadha**,** Bhasker J., “An ASIC Low Power Primer”, Springer. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Describe the concepts of ASIC design methodology, data path elements, logical  effort and FPGA architectures. | L1, L2 |
| 2. | Analyze the design of FPGAs and ASICs suitable for specific tasks, perform  design entry and explain the physical design flow. | L3 |
| 3. | Design data path elements for ASIC cell libraries and compute optimum path  delay. | L6 |
| 4. | Create floorplan including partition and routing with the use of CAD algorithms. | L6 |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | 4 |
| 3. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations | 5 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | | **Assessment methods** |
| 1. Presentation | 1. | Internal Assessment | |
| 1. Video | 2. | Quiz | |
|  |  |  | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – II: Data Base Management System** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC754 | **Credits** | 3 |
| **Course type** | PE – II | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | Understand basic database concepts, including the structure and operation of the relational data model. |
| 2. | Understand and successfully apply logical database design principles, including E-R diagrams and database normalization. |
| 3. | Construct simple and moderately advanced database queries using Structured Query Language (SQL). |
| 4. | Design and implement a small database project. |
| 5. | Understand the concept of a database transaction and related database facilities, including concurrency control and protocols. |
| 6. | Understand the role of the database administrator. |

|  |  |
| --- | --- |
| **Unit - I** | **8 Hours** |
| **Introduction:** Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS.  Data models, schemas and instances; Three-schema architecture and data independence. | |
| **Lab Experiment:** Creation of a database and writing SQL queries to retrieve information from the database. | |

|  |  |
| --- | --- |
| **Unit - II** | **8 Hours** |
| **Entity-Relationship Model:** Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues. | |
| **Lab Experiment:** Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions. | |

|  |  |
| --- | --- |
| **Unit - III** | **8 Hours** |
| **Relational Model and Relational Algebra:** Relational Model Concepts; Relational Model constraints and Relational Database Schemas; Update Operations, Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Examples of Queries in Relational Algebra; | |
| **Lab Experiment:** Creating an Employee database to set various constraints. Creating relationship between the databases. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **SQL:** SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. | |
| **Lab Experiment:** Mini project (Application Development using Oracle/ sql/ Mysql )  a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. | |

|  |  |
| --- | --- |
| **Unit – V** | **8 Hours** |
| **Database Design:** Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms 1NF, 2NF and 3NF; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. | |
| **Lab Experiment:** Mini project (Application Development using Oracle/ sql/ Mysql )  a) Railway Reservation System. b) Personal Information System. c) Web Based User Identification System. d) Timetable Management System. e) Hotel Management System. | |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Elmasri and Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2007 and onwards. |
| 2. | Silberschatz, Korth and Sudharshan, “Data base System Concepts”, 6th Edition, Mc-GrawHill, 2010 and onwards. |
| 3. | C. J. Date, A. Kannan and S. Swamynatham, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006 and onwards. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Master the basic concepts and appreciate the applications of database systems. | L2 |
| 2. | Master the basics of SQL and construct queries using SQL. | L3 |
| 3. | Be familiar with the relational database theory, and be able to write relational algebra expressions for queries | L4 |
| 4. | Master sound design principles for logical design of databases, including the E‐R method and normalization approach | L4 |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations | 5 |
| 3. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | 12 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | | **Assessment methods** |
| 1. Chalk / Blackboard | 1. | Assignments | |
| 1. Presentations | 2. | Internal Assessment Tests | |
| 1. Videos | 3. | Quiz | |
| 1. Demonstration | 4. | Seminar | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – III: Low Power VLSI** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC761 | **Credits** | 3 |
| **Course type** | PE – III | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To study the fundamentals of low power in MOSFET. |
| 2. | Understand the power dissipation at device level. |
| 3. | To inspect gating techniques used. |
| 4. | To study power reduction with special techniques. |
| 5. | To examine and recognize performance management in architectures. |

|  |
| --- |
| **Pre-requisites :**   1. Digital Electronics (16EC32). 2. CMOS VLSI Design (16EC54). |

|  |  |
| --- | --- |
| **Unit – I** | **8 Hours** |
| **Introduction**: Introduction, Sources of power dissipation, designing for low power. Physics of power dissipation in MOSFET devices, MIS Structure, Long channel and sub-micron MOSFET, Gate induced Drain leakage, Power dissipation in CMOS, Short circuit dissipation, dynamic dissipation, Load capacitance. | |
| **Self learning topics:** Low power design limits, Principles of low power design. | |

|  |  |
| --- | --- |
| **Unit – II** | **8 Hours** |
| **Design And Test of Low-Voltage CMOS Circuits:** Introduction, Design style, Leakage current in Deep sub-micron transistors, device design issues, minimizing short channel effect, Low voltage design techniques using reverse V, steep sub threshold swing and multiple threshold voltages, Testing with elevated intrinsic leakage, multiple supply voltages | |

|  |  |
| --- | --- |
| **Unit – III** | **8 Hours** |
| **Logic:** Gate Reorganization, Signal Gating, Logic Encoding, State Machine Encoding, Pre-computation Logic. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **Special Techniques:** Power reduction in Clock Networks, CMOS Floating Node, Low Power Bus, Delay Balancing, Low Power Techniques For SRAM. | |

|  |  |
| --- | --- |
| **Unit – V** | **8 Hours** |
| **Architecture and System:** Power and Performance Management, Switching Activity Reduction, Flow Graph Transformation. | |
| **Self learning topics:** Parallel Architecture with Voltage Reduction. | |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Kaushik Roy and Sharat C Prasad, “Low-Power CMOS VLSI Circuit Design”, John Wiley Pvt. Ltd., 2008 and onwards. |
| 2. | Gary Yeap and Kluwer, “Practical Low power Digital VLSI Design”, Academic Publications, 1998 and onwards. |
| **Reference Books** | |
| 1. | Jan M. Rabaey and Massoud Pedram, "Low-power-design-Methodology", The Springer International Series in Engineering and Computer Science, 1995 and onwards. |
| 2. | Neil H. E. Weste and K. Eshraghian, “Principles of CMOS VLSI Design”, Addison Wesley (Indian reprint), 2nd Edition and onwards. |

**List of Experiments:**

**The experiments are conducted using the software. Hence no hardware is required. These can be worked on the license software namely: Cadence, Mentor Graphics, synopsis and Xilinx ISE.**

1. Techniques at Circuit Level: Multi Threshold, Varying VDD, Use of Sleep transistors.
2. Signal Coding Technique: Use of 2’s complement, Gray code, one-hot coding, Bus inversion coding.
3. Architecture level: Clock gating, Power gating, Isolation techniques.
4. System level: Pipelining and Parallelism.

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Discuss the sources of power dissipation in MOSFET. | L2 |
| 2. | Analyze and verify Low-Voltage CMOS Circuits. | L3,L4 |
| 3. | Understand different gating techniques to reduce power dissipation. | L3, L4 |
| 4. | Comprehend special technique forpower reduction networks. | L2 |
| 5. | Recognize performance management system used in architecture and system. | L2, L3 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | 2 |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | 3 |
| 4. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | 5 |
| 5. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | 12 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | **Assessment methods** | |
| 1. | Black board | 1. | Assignments |
| 2. | Presentation | 2. | Quiz |
| 3. | Videos and MOOC | 3. | Case studies with real time examples. |
| 4. | Practical with EDA tools. | 4. | Projects/ Literature survey. |
|  |  |  |  |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – III: Ad Hoc and Sensor Networks** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC762 | **Credits** | 3 |
| **Course type** | PE – III | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | Understand the constraints of the wireless physical layer that affect the design and performance of ad hoc and sensor networks, protocols, and applications. |
| 2. | To get skilled in wireless networks technology platforms and standards. |
| 3. | To learn real time traffic support in wireless networks with working principles of wireless LAN. |
| 4. | To understand the Principles of Ad hoc wireless and sensor networks. |
| 5. | To get familiar in standards of wireless LAN and learn hybrid networks. |

|  |  |
| --- | --- |
| **Unit - I** | **8 Hours** |
| **Ad Hoc Wireless Networks and MAC:** Introduction, Issues in ad Hoc wireless networks, MAC protocols, Issues, classifications of MAC protocols, Contention based protocols, Contention based protocols with reservation mechanism, Multi channel CSMA and power control MAC protocol. | |

|  |  |
| --- | --- |
| **Unit - II** | **8 Hours** |
| **Routing Protocols and TCP over Ad Hoc:** Issues in designing a routing protocol, Classifications of routing protocols, Hierarchical and power aware. multicast routing, Classifications, Tree based, Mesh based Ad Hoc transport layer issues, TCP over Ad Hoc, Feedback based - TCP with explicit link, TCP-Bus, Ad Hoc TCP and split TCP, Ad Hoc transport protocol. | |

|  |  |
| --- | --- |
| **Unit – III** | **8 Hours** |
| **Quality of Service in Ad Hoc Wireless Networks:** Real-time traffic support, Issues and challenges in providing QoS, Classification of QoS solutions, MAC layer solutions, QoS routing protocols, Ticket based and predictive location based QoS routing protocols, On-Demand link state multipath QoS routing protocol, QoS frameworks, Energy management Ad Hoc, Battery and power management schemes, Transmission power management schemes. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| |  | | --- | | **Basics of Wireless sensors and Applications:** The Mica Mote, Sensing and Communication ranges, Design Issues, Energy Consumptions, Clustering of sensors, applications. | |  | | |
| **Unit - V** | **8 Hours** |
| **Hybrid Wireless Networks:** Introduction, Next generation hybrid wireless architectures, Routing in hybrid wireless networks, Power control schemes and load balancing in hybrid wireless networks, Recent advances in wireless networks, Ultra wide band radio communication, Wireless fidelity systems, Optical wireless networks. | |

**List of Experiments:**

**Following experiments to be conducted using Simulator Ns2/ Ns3**

1. Study Zigbee/Cross Bow Wireless Network.
2. Study ad hoc network formation in different operating system. Implement ad hoc network in one operating system.
3. Implement AODV routing protocol.
4. Implement Wireless LAN MAC scheme with RTS/CTS and without RTS/CTS and analyze the

performance.

1. Create a small topology of nodes in C++/Java. Assign Energy to each node and Elect a node with

highest energy to be Master node.

1. Which signal propagation loss models can be applied to ad hoc network? Implement models in

C++/Java.

1. Create a small topology. Perform data transmission among nodes and calculate throughput. Use

C++/Java/simulator.

1. Create a small topology. Assign symmetric keys and perform encryption. Use

C++/Java/simulator

1. Implement DSR routing protocol.
2. Implement black hole attack. Take 3 nodes in topology.

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols’, New Delhi: Pearson Education, 2004 and onwards. |
| 2. | Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks” Noida: Morgan Kaufman Publishers, 2004 and onwards. |
| 3. | C. K. Toh, “Ad Hoc Mobile Wireless Networks”, New Delhi: Pearson Education, 2002 and onwards. |
| 4. | Thomas Krag and Sebastin Buettrich, “Wireless Mesh Networking”, Mumbai: O’Reilly Publishers, 2007 and onwards. |
| 5. | Carols Corderio, “Adhoc and Sensor Networks -Theory And Applications”, Dharma Prakash Agarwal, World Scientific Publications / Cambridge University Press, March 2006 and onwards. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Explain the performance of various unicast and multicast routing protocols that have been proposed for ad hoc networks. | L2 |
| 2. | Explain the operation of several media access protocols that have been proposed for ad hoc and sensor networks | L2 |
| 3. | Explain the energy issues in sensor networks and how they can be addressed using scheduling, media access control, and special hardware. | L2 |
| 4. | Implement protocols with location based QoS. | L3 |
| 5. | Appreciate the importance of good Ad-Hoc Networks Functionality. | L3 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | 2 |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | 3 |
| 4. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | 5 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course delivery methods** | | | **Assessment methods** | |
| 1. Blackboard and chalk | 1. | Internal Assessment Test | |
| 1. PPT | 2. | Assignment | |
| 1. Video | 3. | Quiz | |
| 1. Demonstration | 4. | Seminar | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – III: Real Time OS** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC763 | **Credits** | 3 |
| **Course type** | PE – III | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To understand the basic concept in the field of Satellite Communication and to know how to place a satellite in an orbit. |
| 2. | To study the propagation impairments and Space link. |
| 3. | [To give the skills necessary to develop software for embedded computer systems using a real-time operating system.](JavaScript:void(0)) |
| 4. | [To provide knowledge and skills that can be applied immediately.](JavaScript:void(0)) |
| 5. | To introduce the principles shared by many real-time operating systems, and their use in the development of embedded multitasking application software |

|  |  |
| --- | --- |
| **Unit - I** | **8 Hours** |
| **Basics of RTOS:** Introduction, Characteristics of Real-Time Tasks, Real-Time Scheduling, Operating System Designs, RTOS for Safety Critical Systems, Multi-Core Architectures, Operating Systems for Wireless Sensor Networks, Real-Time Requirements of Multimedia Application | |

|  |  |
| --- | --- |
| **Unit - II** | **8 Hours** |
| **Real Time Kernel:** Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and study of RTOS VX works and uCOS – Case studies. | |

|  |  |
| --- | --- |
| **Unit - III** | **8 Hours** |
| **Real Time Models:** Event Based – Process Based and Graph based Models, Petrinet Models, Real Time Languages, RTOS Tasks, RT scheduling, Interrupt processing, Synchronization, Control Blocks, Memory Requirements. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **Real Time Memory Management:** Process stack management, TCB model, Run time ring buffer, Dynamic allocation, Swapping, Overlays, Real-time garbage collection. | |

|  |  |
| --- | --- |
| **Unit - V** | **8 Hours** |
| **RTOS Application Domains:** RTOS for Image Processing, Embedded RTOS for voice over IP, RTOS for fault Tolerant Applications, RTOS for Control Systems. | |

**List of Lab Experiments:**

1. Write a C/C++ program for Real time Scheduling.
2. Installation of Real Time OS.
3. Write a C/C++ program for implementing a Real Time Clock.

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Charles Crowley, “Operating Systems-A Design Oriented approach”, McGraw Hill. |
| 2. | C.M. Krishna, Kang, G.Shin, “Real Time Systems”, McGraw Hill. |
| **Reference Books** | |
| 1. | Phillip Laplante, “Real – time Systems design and analysis”, PHI. |
| 2. | Raymond J.A.Bhur, Donald L.Bailey, “An Introduction to Real Time Systems”, PHI. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Evaluate the suitability of an operating system for real-time applications. | L5 |
| 2. | Describe and apply commonly used abstract models and terminology for real-time scheduling and resource management. | L4 |
| 3. | Understand and apply the proofs of the fundamental theorems of deadline and fixed priority real-time scheduling. | L4 |
| 4. | To select an appropriate software architecture and combination of scheduling techniques to satisfy a set of timing requirements. | L3 |
| 5. | Empirically estimate the accuracy and overhead of a real-time scheduler. | L4 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | 2 |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | 3 |
| 4. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | 5 |
|  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | | **Assessment methods** |
| 1. Black board teaching | 1. | Assignments | |
| 1. PPT | 2. | CIE | |
| 1. Video | 3. | Quiz | |
|  |  |  | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Elective – III: Multimedia Communication** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16EC764 | **Credits** | 3 |
| **Course type** | PE – III | **CIE Marks** | 50 |
| **Hours/week: L-T-P** | 3 – 0 – 2 | **SEE Marks** | 50 |
| **Total Hours:** | 40 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | Understand the Concepts and Fundamentals of digital information compression. |
| 2. | Apply and analyze mathematical transform for Multimedia information. |
| 3. | Understand the design procedure of Video CoDec. |
| 4. | Analyze JPEG, JPEG 2000 still image standards. |
| 5. | Analyze and evaluate MPEG 4 and H.264 AVC CoDec standards. |
|  |  |

|  |  |
| --- | --- |
| **Unit - I** | **8 Hours** |
| **Fundamentals:** Practical need for Audio, image and video compression, statistical and psychovisual redundancy, Quantization - uniform, non uniform, Audio compression - Psychoacoustics, Audio CoDec, Lossless Compression MPEG-4, Lossy Compression G.719, AC3. | |

|  |  |
| --- | --- |
| **Unit - II** | **8 Hours** |
| **Coding standard:** Transform coding, DCT and DWT (for data compression), Variable length coding, Huffman codes, Arithmetic codes, Dictionary codes - LZ77 and LZ78. | |
| **Unit – III** | **8 Hours** |
| **Still Image and Video Compression:** Still image compression coding standards, JPEG, JPEG 2000, Motion estimation and motion compensation, Block matching, fundamentals of digital video coding. | |

|  |  |
| --- | --- |
| **Unit – IV** | **8 Hours** |
| **Digital video coding standard and applications:** MPEG 1/2 video coding, MPEG-4 video standards (Block diagram study), Introduction and fundamentals H.261, H.263. | |

|  |  |
| --- | --- |
| **Unit - V** | **8 Hours** |
| H.264 AVC (Block diagram study), and SVC standards (Block diagram study), Comparative study of MPEG-4 and H.264 AVC. | |
| **Self learning topics:** Overview of the Scalable Video Coding. | |

**List of Lab Experiments:**

**Software Experiments:**

1. Entropy Coding.
2. Quantization.
3. Motion Estimation and Compensation.
4. Transform Coding and Intra-Coding Chain.
5. Video Codec.

**-** Experiments to be conducted using MATLAB/ SIMULINK

**Hardware Experiments:**

1. Demonstration of working of Scanner.
2. Interface of Webcam.
3. PCM using real-time audio from PC.
4. Benchmarking of Compression Techniques.
5. Character Recognition.

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Yun Q. Shi and Huifang Sun, "Image and Video Compression for Multimedia Engineering: Fundamentals, Algorithms, and Standards, CRC Press, 2008 and onwards. |
| **Reference Books** | |
| 1. | Ze-Nian Li and Mark S. Drew, “Fundamentals of Multimedia”, Prentice Hall. |

|  |  |  |
| --- | --- | --- |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Identify and describe multimedia signal processing and communications | L2 |
| 2. | Analyze and report different transforms for video coding. | L4 |
| 3. | Describe and compare Video CoDec designs. | L3 |
| 4. | Describe a number of standards, including H.26x, Moving Picture Expert Group (MPEG), and Joint Photographic Expert Group (JPEG). | L4 |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | 2 |
| 3. | **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | 3 |
| 4. | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | 4 |
| 5. | **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. | 10 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course delivery methods** | | | **Assessment methods** |
| 1. Black board | 1. | IA Test | |
| 1. PPT | 2. | Assignment | |
| 1. Videos | 3. | Quiz | |
| 1. Demonstrations | 4. | Course project/seminar | |
|  |  |  | |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Components | Average of best two IA tests out of three | Average of two assignments / activity | Quiz | Class participation | Total  Marks |
| Maximum Marks: 50 | 25 | 10 | 5 | 10 | 50 |
| * Writing two IA test is compulsory. * **Minimum marks required to qualify for SEE : Minimum IA test marks (Average) 10 out of 25 AND total CIE marks 20** | | | | | |

|  |
| --- |
| **Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.** |

|  |  |
| --- | --- |
| **Scheme of Semester End Examination (SEE):** | |
| 1. | It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA. |
| 2. | **Minimum marks required in SEE to pass: 40** |
| 3. | Question paper contains 08 questions each carrying 20 marks. Students have to answer FIVE full questions. SEE question paper will have two compulsory questions (any 2 units) and choice will be given in the remaining three units. |

|  |
| --- |
| **Communication and Networking Lab** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16ECL77 | **Credits** | 2 |
| **Course type** | L1 | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 0 – 0 – 3 | **SEE Marks** | 25 |
| **Total Hours:** | 36 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course learning objectives** | |
| 1. | To study of different types network cables network devices and IP. |
| 2. | To study how to connect the computers in Local area network. |
| 3. | To study and understand the different network commands and network configuration commands. |
| 4. | To study and Make use of Packet tracer simulation tool. |
| 5. | To study how to configure a network and different vector routing protocols using Packet tracer. |

Following experiments shall be conducted using C/MATLAB/NS2/ Packet Tracer tools

|  |  |
| --- | --- |
| **List of experiments** | |
| 1. | PC to PC Communication. |
| 2. | Parallel Communication using 8 bit parallel cable. |
| 3. | Serial communication using RS 232C. |
| 4. | Ethernet LAN protocol. |
| 5. | Create scenario and study the performance of CSMA/CD protocol through simulation. |
| 6. | Token bus and token ring protocols. |
| 7. | Create scenario and study the performance of token bus and token ring protocols through simulation. |
| 8. | Wireless LAN protocols. |
| 9. | Create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols. |
| 10. | Implementation and study of stop and wait protocol. |
| 11. | Implementation and study of Goback-N and selective repeat protocols. |
| 12. | Implementation of distance vector routing algorithm. |
| 13. | Implementation of Link state routing algorithm. |
| 14. | Implementation of Data encryption and decryption. |
| 15. | Transfer of files from PC to PC using Windows. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Text Books** | | | |
| 1. | Behrouz A Forouzan, “Data Communication and Networking”, Tata McGraw-Hill Publishing Company Limited, Indian Edition, 2006 and onwards. | | |
| **Reference Books** | | | |
| 1. | Larry L. Peterson and Bruce S. Devie, “Computer Networks”, Morgan Kaufmann Publications, 5th Edition, 2008 and onwards. | | |
| **Course Outcome (COs)** | | | | |
| At the end of the course, the student will be able to | | | Bloom’s Level | |
| 1. | | Understand the working of different types of network cables and network devices and IP. | L2 | |
| 2. | | Connect two computers in Local area network. | L3 | |
| 3. | | Understand the different network commands and network configuration commands. | L2 | |
| 4. | | Analyze Packet tracer simulation tool effectively. | L4 | |
| 5. | | Configure a network and different vector routing protocols using Packet tracer. | L5 | |

|  |  |  |  |
| --- | --- | --- | --- |
| **Program Outcome of this course (POs)** | | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems | | 1 |
| 2. | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | | 4 |
| 3. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. | | 5 |
| 4. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | | 12 |
| **Assessment methods** | |
| 1. | Internal Assessment |
| 2. | Quiz |
| 3. | Mini Project/ Activity |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |
| --- | --- | --- | --- |
| Components | Conduct of the lab | Journal submission | Total  Marks |
| Maximum Marks: 25 | 10 | 15 | 25 |
| * Submission and certification of lab journal is compulsory to qualify for SEE. * **Minimum marks required to qualify for SEE : 13 marks out of 25** | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| **Scheme of Semester End Examination (SEE):** | | | |
| 1. | It will be conducted for 50 marks of 3 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.** | | |
| 2. | Only one experiment to be conducted. | | |
| 3. | **Minimum marks required in SEE to pass: 20/50 (10/25)** | | |
| 4. | Initial write up | 10 marks | 50 marks |
| Conduct of experiments, results and conclusion | 20 marks |
| Viva- voce | 20 marks |
| 5. | **Viva-voce shall be conducted for individual student and not in a group.** | | |

|  |
| --- |
| **Wireless and Mobile Communication Lab** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | 16ECL78 | **Credits** | 2 |
| **Course type** | L2 | **CIE Marks** | 25 |
| **Hours/week: L-T-P** | 0 – 0 – 3 | **SEE Marks** | 25 |
| **Total Hours:** | 36 | **SEE Duration** | 3 Hours |

|  |  |
| --- | --- |
| **Course Learning Objectives (CLOs)** | |
| 1. | To study Tx /Rx signals and their constellation. |
| 2. | To study Audio unit of GSM phone. |
| 3. | To study performance and detection of SIM and GSM data services. |
| 4. | To study Wireless Access Point (WAP). |
| 5. | To study MIMO communication. |

**Following experiments shall be conducted using Mobile Phone Trainer ST2132 kit**

|  |  |
| --- | --- |
|  | |
| 1. | Study of the Tx IQ/Rx IQ signals. |
| 2. | Observe signal constellation. |
| 3. | Study working of Audio IC and observe the signals. |
| 4. | Study and verify the performance of SIM Detection. |
| 5. | Study and Measure the PWM signal of Vibrator. |
| 6. | Study and Analyze the Buzzer in GSM Handset. |
| 7. | Study GSM communication Data Services and Capability. |
| 8. | Study and Configure setting up of WAP. |
| 9. | Introduction to MIMO Communication and Multiplexing. |
| 10. | Introduction to MIMO OFDM. . |

|  |  |
| --- | --- |
| **Text Books** | |
| 1. | Mullet, “Wireless Telecom: Systems and networks”, Thomson Learning, 2006 and onwards. |
| 2. | Oliver Hersent, David Boswatrhick and Omar Elloumi, “The Internet of Things Applications and Protocols”, Willey India Pvt. Ltd. |
| 3. | V.Madisetti and A. Bahga, “IoT: A hands on approach”, Learning, 2004 and onwards. |
| **Reference Books** | |
| 1. | Lee W.C.Y, “Mobile Cellular Telecommunication”, MGH, 2nd Edition, 2009 and onwards. |
| 2. | D P Agrawal, “Wireless communication, 2nd Edition, Thomson learning 2007 and onwards. |
| 3. | David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge 2005 and onwards. |
| 4. | S. S. Manvi, M. S. Kakkasageri, “Wireless and Mobile Network concepts and protocols”, John Wiley India Pvt. Ltd, 1st Edition, 2010 and onwards. |

|  |  |  |
| --- | --- | --- |
|  | | |
| **Course Outcome (COs)** | | |
| At the end of the course, the student will be able to | | Bloom’s Level |
| 1. | Outline basics of cellular communication, Tx and Rx signals and Constellation . | L2 |
| 2. | Explain the working of Audio IC and Measure audio signals. | L1/L5 |
| 3. | Detect SIM in GSM network and verify performance. | L2 |
| 4. | Analyze Buzzer in GSM handset and List GSM services. | L3 |
| 5. | Configure WAP. | L5 |

|  |  |  |
| --- | --- | --- |
| **Program Outcome of this course (POs)** | | **PO No.** |
| 1. | **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. | 1 |
| 2. | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. | 4 |
| 3. | **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations | 5 |
| 4. | **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development. | 7 |
| 5. | **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. | 12 |

|  |  |
| --- | --- |
| **Course delivery methods** | |
| 1. | Internal Assessment |
| 2. | Quiz |
| 3. | Mini Project/ Activity |

**Scheme of Continuous Internal Evaluation (CIE):**

|  |  |  |  |
| --- | --- | --- | --- |
| Components | Conduct of the lab | Journal submission | Total  Marks |
| Maximum Marks: 25 | 10 | 15 | 25 |
| * Submission and certification of lab journal is compulsory to qualify for SEE. * **Minimum marks required to qualify for SEE : 13 marks out of 25** | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| **Scheme of Semester End Examination (SEE):** | | | |
| 1. | It will be conducted for 50 marks of 3 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.** | | |
| 2. | Only one experiment to be conducted. | | |
| 3. | **Minimum marks required in SEE to pass: 20/50 (10/25)** | | |
| 4. | Initial write up | 10 marks | 50 marks |
| Conduct of experiments, results and conclusion | 20 marks |
| Viva- voce | 20 marks |
| 5. | **Viva-voce shall be conducted for individual student and not in a group.** | | |

**Bloom’s Taxonomy of Learning Objectives**

Bloom’s Taxonomy in its various forms represents the process of learning.  It was developed in 1956 by Benjamin Bloom and modified during the 1990’s by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom’s) to make it relevant to the 21st century.   The **revised taxonomy** given below emphasizes what a learner “Can Do”.

|  |  |  |
| --- | --- | --- |
| **Lower order thinking skills (LOTS)** | | |
| L1 | Remembering | Retrieve relevant knowledge from memory. |
| L2 | Understanding | Construct meaning from instructional material, including oral, written, and graphic communication. |
| L3 | Applying | Carry out or use a procedure in a given situation – using learned knowledge. |
| **Higher order thinking skills (HOTS)** | | |
| L4 | Analyzing | Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task. |
| L5 | Evaluating | Make judgments based on criteria and standards, using previously learned knowledge. |
| L6 | Creating | Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea. |

