SYLLABUS

(WITH EFFECT FROM 2018-19)

ಮ್ಮಸ್

(ವೀಡಿಯೋಚಯಾತ್ರಿಯ 2018–19)

V to VI Semester

Bachelor Degree

in

Electronics & Communication Engineering

OUT COME BASED EDUCATION

WITH

CHOICE BASED CREDIT SYSTEM

P.E.S. College of Engineering

Mandya - 571 401, Karnataka

(An Autonomous Institution Affiliated to VTU, Belagavi,
Grant -in- Aid Institution (Government of Karnataka), World Bank Funded College (TEQIP)
Accredited by NBA, New Delhi and Approved by AICTE, New Delhi.)

Ph : 08232- 220043, Fax : 08232 – 222075, Web : www.pescemandya.org
Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight Undergraduate and Six Postgraduate programs. It consists of four M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

*Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.*

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a ‘cafeteria’ type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills, Personality Development modules and Technical Skills have been added to the existing curriculum of the academic year 2018-19. Internship have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Technical Skills and Skill Oriented Lab are included in all undergraduate programs.

Dr. Umesh D R
Deputy Dean (Academic)
Associate Professor,
Dept. of CS & Engg

(Dr. Nagarathna)
Dean (Academic)
Professor
Dept. of CS & Engg
P.E.S. College of Engineering

VISION
PESCE shall be a leading institution imparting quality engineering and management education, developing creative and socially responsible professionals

MISSION
PEM1: Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices
PEM2: Impart engineering and managerial skills through competent and committed faculty using Outcome Based Educational curriculum
PEM3: Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs
PEM4: Promote research, product development and industry-institution interaction.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Vision
The department of E & C would endeavour to create a pool of Engineers who would be extremely competent technically, ethically strong also fulfil their obligation in terms of social responsibility.

Mission
- M1: Adopt the best pedagogical methods and provide the best facility, infrastructure and an ambience conducive to imbibe technical knowledge and practicing ethics.
- M2: Group and individual exercises to inculcate habit of analytical and strategic thinking to help the students to develop creative thinking and instil team skills
- M3: MoUs and Sponsored projects with industry and R & D organizations for collaborative learning
- M4: Enabling and encouraging students for continuing education and moulding them for lifelong learning process

Program Educational Objectives:
PEO1: Graduates to exhibit knowledge in mathematics, engineering fundamentals applied to Electronics and Communication Engineering for professional achievement in industry, research and academia
PEO2: Graduates to identify, analyse and apply engineering concepts for design of Electronics and Communication Engineering systems and demonstrate multidisciplinary expertise to handle societal needs and meet contemporary requirements
PEO3: Graduates to perform with leadership qualities, team spirit, management skills, attitude and ethics need for successful career, sustained learning and entrepreneurship.

Program Specific Outcomes (PSOs):
Program Specific Outcomes of bachelor degree (B.E, E&C) program are defined as follows which are in line with the Program specific criteria (PSC) as defined by IEEE.
After the graduation, the student will have:
- An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them in the design and implementation of Electronics and communication systems.
- An ability to solve complex problems in Electronics and Communication Engineering, using latest hardware and software tools, along with analytical skills to arrive at appropriate solutions.
### SCHEME OF TEACHING AND EXAMINATION
V SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Department</th>
<th>Hrs / Week</th>
<th>Credits</th>
<th>Examination Marks</th>
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<tr>
<td>1</td>
<td>P18EC51</td>
<td>Innovation, Entrepreneurship and Management</td>
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<td>ECE</td>
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<td>ECE</td>
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<td>P18EC54</td>
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<td>6</td>
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<td>ECE</td>
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<td>P18ECL58</td>
<td>Skill Oriented Laboratory – I</td>
<td>ECE</td>
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<td>Aptitude and Reasoning Development - Advance (ARDI)</td>
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**Total** 25 500 500 1000

### Professional Elective – I

<table>
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<tr>
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<tbody>
<tr>
<td>1</td>
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<td>Fundamentals of Object Oriented Language and Database Concepts</td>
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<td>2</td>
<td>P18EC552</td>
<td>DSP Processor and Applications</td>
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<td>3</td>
<td>P18EC553</td>
<td>ARM Processor</td>
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<td>4</td>
<td>P18EC554</td>
<td>Adaptive Signal Processing</td>
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<td>5</td>
<td>P18EC555</td>
<td>Cognitive Radio Networks</td>
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### Technical Skills – I

<table>
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<tbody>
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<td>1</td>
<td>P18EC591</td>
<td>Embedded System and IOT</td>
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<td>2</td>
<td>P18EC592</td>
<td>System Verilog</td>
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<tr>
<td>3</td>
<td>P18EC593</td>
<td>Java and Web Technologies</td>
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# SCHEME OF TEACHING AND EXAMINATION
## VI SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

<table>
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<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
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<th>Hrs / Week</th>
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<td>Circuit Simulation Laboratory</td>
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## Professional Elective – II

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<td>Multimedia Communication</td>
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<td>P18EC642</td>
<td>Radar and Navigational Systems</td>
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<td>P18EC643</td>
<td>Introduction to Basics of Information Technology</td>
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<td>P18EC644</td>
<td>VLSI Testing and Verification</td>
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## Open Elective – I

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<td>P18ECO651</td>
<td>Electronic Waste Management</td>
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<td>2</td>
<td>P18ECO652</td>
<td>Principles of Communication Systems</td>
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<td>3</td>
<td>P18ECO653</td>
<td>Arduino Controller with Applications</td>
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<td>Biometrics</td>
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<td>5</td>
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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Categorize research, innovation and creativity.
2. Relate the role and importance of innovation in economic growth, skills of innovator, types of innovation and output forms of innovation.
3. Understand various ways to create and manage intellectual property and prepare innovation proposal.
4. Understand the entrepreneurial process and recognize the core role of creativity and innovation in managing the entrepreneurial process effectively.
5. Understand fundamental concepts and principles of management, including the basic roles, skill, and functions of management.
6. Summarize comprehensive Entrepreneurship Development process.
7. Understand the procedure of creating an Ownership and types.
8. Express the meaning of Professional Ethics, its importance and needs.

B. Course Content

UNIT- I
Introduction to Innovation and Innovator: Introduction, understanding Innovation, Creativity and Research, Role of Innovation in economic growth of country, companies and community, phases of innovation journey, Roles of Innovator.
Text 1: Chapter 1 to 5 10 Hrs
Self Learning Components: Prepare a Case study of An Innovator: How did he/she find the problem, thought about a solution and steps/situations came across during implementation.

UNIT - II
Innovator Skills and Innovation: Introduction to Innovative Skills, Types of Innovation, Introduction to patents and IP, preparing an innovation proposal Pitching an innovation proposal, Sustaining innovation.
Text 1: Chapter 6 to 13 10 Hrs
Self Learning Components: Prepare a case study of an entrepreneur around you.

UNIT - III
Entrepreneurship and Entrepreneurs:
Evolution of the concept of Entrepreneur, Characteristics of an Entrepreneur, Distinction between an Entrepreneur & a Manager, Functions of an Entrepreneur, Types of Entrepreneur. Concept of Entrepreneurship, Growth of Entrepreneurship in India, Role of Entrepreneurship in Economic Development.
Text 2: 1.1 to 1.10, 2.1 to 2.3 11 Hrs
Self Learning Components: Prepare a Case Study of an Entrepreneur / an Enterpriser or an Enterprise.
UNIT - IV
Forms of Business Ownership: Sole Proprietorship, Partnership, Company, Cooperative, Selection of Appropriate Form of Ownership Structure.

Text 2: 24.1 to 24.9 & 18.1 to 18.5 10 Hrs
Self Learning Components: Being in different positions as an employee: Understanding Self, Self-Management& Understanding others for Effective Relationships and Communication (Ref Book: 6)

UNIT - V
Engineering and Professional Ethics: Making a Case: Introduction, Role Morality, What is a Profession?, Professional Ethics, The NSPE Board of Ethical Review, Engineering Ethics as Preventive Ethics
Honesty: Introduction, Ways of Misusing Truth, Why is Dishonesty Wrong?

Text 3: 1.1 to 1.6, 6.1 to 6.3 & 10.1 to 10.8 11 Hrs
Self Learning Components: Survey and Study the importance of Professional Ethics

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:

REFERENCE BOOKS:
### C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Able to <strong>Understand</strong> the Functionalities and Requirements to Innovate.</td>
<td>PO1 (L3), PO9 (L1), PO12 (L1)</td>
</tr>
<tr>
<td>CO2</td>
<td><strong>Analyze</strong> the Importance of Innovation and Entrepreneurship to build an Enterprise Resulting in Economic Growth.</td>
<td>PO2 (L3), PO9 (L3), PO12 (L3)</td>
</tr>
<tr>
<td>CO3</td>
<td><strong>Demonstrate</strong> the Entrepreneurial and Management Process.</td>
<td>PO3 (L3), PO7 (L4), PO9 (L4), PO12 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td><strong>Understand</strong> reliability of Innovation, Entrepreneurship and Management</td>
<td>PO1 (L3), PO6 (L1), PO9 (L1), PO12 (L1)</td>
</tr>
<tr>
<td>CO5</td>
<td><strong>Understand</strong> Professional Ethics, <strong>Analyze</strong> its importance and need in current working environment.</td>
<td>PO1 (L3), PO2 (L2), PO8 (L3), PO9 (L3), PO12 (L3)</td>
</tr>
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### D. Course Articulation Matrix (CAM)

<table>
<thead>
<tr>
<th>CO</th>
<th>PO 1</th>
<th>PO 2</th>
<th>PO 3</th>
<th>PO 4</th>
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<th>PO 7</th>
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</tbody>
</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the basic knowledge of digital CMOS VLSI circuits and design.
2. Explain the basic electrical and physical properties of MOS transistor.
3. Discuss the dc characteristics of MOS inverter.
4. Describe the switching characteristics and delay of MOS inverter which determines the overall operating speed of digital systems.
5. Examine the static and dynamic characteristics of various combinational MOS logic circuits and sequential logic circuits.
6. Discuss the operation of dynamic logic circuits of reduced circuit delay and silicon area, compared to static logic circuits.
7. Provide the knowledge of I/O circuits, clock generation and distribution circuits which are essential in VLSI design chip.
8. Able to understand IC fabrication process of MOS Transistor.

B. Course Content

UNIT – I
Introduction: Historical Perspective, VLSI Design Flow,
MOS Transistor: The Metal Oxide Semiconductor(MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current – Voltage Characteristics. MOSFET Scaling and Small geometry effects,
Text 1: – 1.1, 1.5 &3.1 to 3.5. 10 Hrs
Self Learning Component: Design hierarchy, VLSI Design Styles

UNIT – II
MOSFET Capacitance: Introduction, Oxide related capacitance, Junction capacitance
Text 1: –3.6, 5.1, 5.4 and 6.1, 6.2, 6.5, 6.6, 6.7. 10 Hrs
Self Learning Component: Super buffer Design.

UNIT – III
Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion nMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates(Pass Gates)
Sequential MOS Logic Circuits: Introduction, Behavior of Bistable Elements, SR Latch Circuit
Text 1: – 7.1 to 7.5, 8.1 to 8.3 11 Hrs
Self Learning Component: Modeling of MOS Transistor using SPICE: Know about MODEL statement in SPICE. Plot O/P characteristics of N-MOS and P-MOS transistors and C-MOS inverter using, LEVEL-1 and LEVEL-2 model in SPICE and Scilab/Math lab.

UNIT – IV

Text 1:– 9.1 to 9.6 10 Hrs
Self Learning Component: Design Margin, Supply Voltage, Temperature, Process Variation, Design Corners, Reliability, Reliability Terminology, Electro migration, Self-Heating, Hot Carriers, Overvoltage, Failure, Soft Errors,

UNIT – V
Fabrication of MOSFETS: Introduction, Fabrication Process flow, Fabrication of NMOS transistor, Device Isolation Techniques, Local oxidation of silicon, Multilevel interconnects and metallization.
BiCMOS Logic Circuits: Basic BiCMOS circuits, BiCMOS applications

Text 1: – 2.1, 2.2. 12.4, 12.6. 13.1 to 13.6 11 Hrs
Self Learning Components: CMOS smart temperature sensors for RFID applications
Ref: https://ieeexplore.ieee.org/document/6644858
CMOS VLSI Applications

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:

REFERENCE BOOKS:
ONLINE COURSES AND VIDEO LECTURES:

1. [https://nptel.ac.in/courses/108/107/108107129/](https://nptel.ac.in/courses/108/107/108107129/) (By Sudeb Dasgupta IIT Roorkee)

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>To <strong>Apply</strong> the basic knowledge of Physics and mathematics to understand the MOS and derive different current equations of MOS circuits and delays of CMOS inverter circuits</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO2</td>
<td>To <strong>Analyze</strong> the CMOS inverter circuit and BiCMOS circuits.</td>
<td>PO2 (L4)</td>
</tr>
<tr>
<td>CO3</td>
<td>To <strong>Design</strong> combinational, sequential and Dynamic circuits based on CMOS inverters for the given specifications.</td>
<td>PO3 (L5)</td>
</tr>
<tr>
<td>CO4</td>
<td>To <strong>Discuss</strong> various issues related to clocking, I/O and protection in MOS and VLSI Fabrication Process</td>
<td>PO1 (L4)</td>
</tr>
<tr>
<td>CO5</td>
<td>Work in groups to model transistors and its circuits learning new tools</td>
<td>PO5, PO9, PO12 (L4)</td>
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D. Course Articulation Matrix (CAM)

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</table>

P18 Scheme, III Year (V & VI Semester) Syllabus
A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the knowledge of probability, information theory and source coding theorem.
2. Analyze the efficient data compression methods and describe the most efficient compression method.
3. Develop the channel model and channel capacity theorem.
4. Describe the linear block codes, cyclic codes and BCH codes.
5. Discuss the encoding and decoding of convolution codes, concept of trellis coded modulation and concepts of cryptography.
6. Discuss the advanced data encryption standards.

B. Course Content

UNIT – I


Text 1: 1.1-1.18 10 Hrs

Self Learning Component:
1. Understand the properties of codes and applications of information theory.
2. Study and compare the different lossy and lossless compression.

UNIT – II

Channel Capacity and Coding: Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, Parallel Gaussian Channels, The Shannon Limit, Channel Capacity for MIMO Systems, Capacity Region for Multiple Access Channels, Random Selection of Codes,

Error Control Coding (Channel Coding): Linear Block Codes for Error Correction, Introduction to Error Correcting Codes, basic definitions, Matrix Description of Linear Block, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check (LDPC) Codes, Optimal Linear Codes, Maximum Distance Separable (MDS) Codes, Bounds on Minimum Distance, Space Time Block Codes.

Text 1: 2.1-2.10, 3.1-3.15 11 Hrs

Self Learning Component:
1. Identify the practical Applications of MIMO system.
2. Understand the uses of Linear and non Linear block codes.
UNIT – III

**Cyclic Codes:** Introduction to Cyclic Codes, Polynomials, The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Quasi-Cyclic Codes and Shortened Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check (CRC) Codes,

**Bose–Chaudhuri Hocquenghem (BCH) Codes:** Introduction to BCH Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials in Terms of Minimal Polynomials, Some Examples of BCH Codes, Decoding of BCH Codes, Reed-Solomon Code, Implementation of Reed-Solomon Encoders and Decoders

*Text 1: 4.1-4.10, 5.1-5.8*  
*11 Hrs*

**Self Learning Component:**
1. Discuss the concept of Convolutional Codes.
2. What are AWGN Channel and identify the noises associated.

UNIT – IV

**Coding for Secure Communications:** Cryptography- Introduction to Cryptography, An Overview of Encryption Techniques, Operations used by Encryption Algorithms, Symmetric (Secret Key) Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC Ciphers, Asymmetric (Public-Key) Algorithms, The RSA Algorithm, Pretty Good Privacy (PGP), One-way Hashing, Other Techniques, Elliptic Curve Cryptography, Diffie Hellman key agreement protocol, Secure Communication using Chaos Functions, Quantum Cryptography, Biometric Encryption, Cryptanalysis, Politics of Cryptography

*Text 1: 9.1-9.19*  
*10 Hrs*

**Self Learning Component:**
1. Discuss the concept of Elliptic curve cryptography.
2. Apply the Cryptography concept in digital signature.

UNIT – V

**Block Cipher and the Data Encryption Standard:** Block Cipher Principles, The Data Encryption Standard, A Des Example, The Strength of Des, Differential and Linear Cryptanalysis, Block Cipher Design Principles,

**Advance Encryption Standard:** Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example, AES Implementation,

*Test 2: 3.1.-3.6, 5.1-5.6*  
*10 Hrs*

**Self Learning Component:**
1. Understand and apply the advance AES algorithm in image processing.
2. Compare the symmetric and Asymmetric algorithms.

**Note:** No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

**TEXT BOOKS:**
REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:
1. NPTEL course on “Information Theory, coding and Cryptography by Dr Ranjan Bose, IIT Delhi, https://nptel.ac.in/courses/108/102/108102117/

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td><strong>Apply</strong> knowledge of mathematics to understand concepts of Probability, Information theory, communication channel, source codes and cryptography.</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO2</td>
<td><strong>Analyze</strong> different source codes for its efficiency used with communication channels.</td>
<td>PO2 (L4)</td>
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<tr>
<td>CO3</td>
<td><strong>Design</strong> coding schemes for a given specifications and evaluate for their error correcting capability.</td>
<td>PO3 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td><strong>Discuss</strong> different lossy / lossless data compression schemes and analyze various decoding schemes for reconstruction of transmitted data.</td>
<td>PO2 (L4)</td>
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<tr>
<td>CO5</td>
<td><strong>Discuss</strong> various cryptography algorithms for secured communication.</td>
<td>PO2 (L4)</td>
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D. Course Articulation Matrix (CAM)

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</table>
Course Title: **Optical Communication Systems and Networks (CC-3)**

<table>
<thead>
<tr>
<th>Course Code: P18EC54</th>
<th>Semester: V</th>
<th>L-T-P-H: 4-0-0-4</th>
<th>Credits: 4</th>
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</thead>
<tbody>
<tr>
<td>Contact Period: Lecture: <strong>52 Hrs.</strong>, Exam: <strong>3 Hrs.</strong></td>
<td>Weightage: CIE: <strong>50%</strong> SEE: <strong>50%</strong></td>
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</table>

**A. Course Learning Objectives (CLOs)**

This course aims to:

1. Discuss the types, characteristics, constitution and application of optical fibers.
2. Describe the propagation of light waves through the fibers.
3. State the causes for the absorption mechanisms in fibers.
4. Explain the bending losses in fibers.
5. Discuss the construction and operation of optical sources.
6. List the different lensing schemes for coupling improvement.
7. Outline the physical principles of photodiodes.
8. Explain the digital link and analog link.
9. Discuss the WDM concepts and components.
10. Describe the optical amplifiers and optical networks.

**B. Course Content**

**UNIT – I**


**Optical Sources**: Light–Emitting Diodes (LEDs), Laser Diodes.

Text 1: 2.2, 2.3, 2.9, 3.1, 3.2, 3.2.1, 3.2.2, 3.2.5, 3.2.6, 3.2.8, 4.2, 4.3, 4.3.1-4.3.5

10 Hrs

Self Learning Components: Mode field diameter, Graded index fiber structure, Fiber materials, Photonic crystal fibers.

**UNIT – II**

**Power Launching and Coupling**: Source to fiber power launching, lensing schemes for coupling improvement, fiber to fiber joints, fiber splicing.

**Photo Detectors**: Physical principles of photodiodes, photo detector noise, detector response time.

**Digital Links**: Point to point links.

Text 1: 5.1, 5.2, 5.3, 5.5, 6.1, 6.2, 6.3, 8.1

10 Hrs

Self Learning Components: LED coupling to single mode fibers, Optical fiber connectors, Structures for INGAAS APDS.

**UNIT – III**

**Optical Receiver Operation**: Fundamental receiver operation, eye diagrams, burst mode receivers, analog receivers.

**Analog Links**: Overview of analog links, carrier to noise ratio, multichannel transmission techniques, RF over fiber.

**WDM Concepts and Components**: Overview of WDM, passive optical couplers, isolators and circulators, fiber grating filters.

Text 1: 7.1, 7.3, 7.4, 7.5, 9.1 to 9.4, 10.1 to 10.4

11 Hrs

UNIT – IV


Components: Optical Amplifiers.

Text 2: 1.1 to 1.8, 3.4 10 Hrs

Self Learning Components:


UNIT – V


WDM Network Elements: Optical line terminals, optical line amplifiers, Optical Add/Drop multiplexers, Optical Cross connects.

Control and Management: Network Management functions, Performance and fault management, Configuration management.

Text 2: 6.1, 6.2, 7.1 to 7.4, 8.1, 8.5, 8.5.1 to 8.5.4, 8.6 11 Hrs

Self Learning Components:


Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:


REFERENCE BOOKS:


ONLINE COURSES AND VIDEO LECTURES:

1. https://nptel.ac.in/courses/115/107/115107095/ (By Dr. Vipul Rastogi, IIT Roorkee)

2. https://nptel.ac.in/courses/108/104/108104113/ (By Prof. Pradeep Kumar K, IIT Kanpur)
### C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Apply the knowledge of physics to explain basic optical laws, various optoelectronic devices and its structures.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the causes for different losses in an optical communication link.</td>
<td>PO2 (L3)</td>
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<tr>
<td>CO3</td>
<td>Develop a solution for optical communication systems for specified characteristics.</td>
<td>PO2, PO3 (L3)</td>
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<tr>
<td>CO4</td>
<td>Examine the methods to improve coupling efficiency and signal-to-noise ratio of the communication system.</td>
<td>PO1, PO2 (L3)</td>
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<tr>
<td>CO5</td>
<td>To Enrich the knowledge about optical communication systems and networks</td>
<td>PO2 (L3)</td>
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### D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLOs)
1. Explain the significance of object oriented concepts
2. Describe the concept of class, objects and methods in Java
3. Apply the concepts of inheritance and interfaces in Java
4. Illustrate usage of packages, string handling and exception handling in Java
5. State the importance of DBMS and explain how DBMS is better than traditional File Processing Systems.
6. Analyze the basic structure of Database and recognize the different views of the database.
8. Analyze and use Relational Data Model, while comparing with other data models.

B. Course Content

UNIT – I


Java: History and features, Simple Java Program, Java Program Structure, Data types, Scope of variables, Operators overview

Decision Making and Branching: if, if else, else if ladder, nesting of if else statements, switch

Decision Making and Looping: do, while, for, Jumps in loops.

Text 1:1.1-1.5, 2.1, 2.2, 3.2, 3.5, 4.4, 4.5, 5.1-5.9, 6.2-6.7, 7.2-7.5. 10 Hrs

Self Learning Components: How Java is different from C and C++, Java environment.

UNIT – II

Classes, Objects and Methods: Introduction, Defining a class, Fields declaration, Methods declaration, Creating objects, Accessing class members, Constructors, Method Overloading, Static members, Nesting of Methods, Inheritance, Overriding methods.

Arrays: Creating array, 1D array and 2D array.

Text 1:8.1-8.12, 9.2-9.3. 10 Hrs

Self Learning Components: Understand the concept of Inheritance: Defining subclass, Subclass Constructor.

UNIT – III

Strings: String Arrays, String Methods

Interfaces: Introduction, Defining interfaces, Extending interfaces, implementing interfaces

Packages: Introduction, Java API packages, Using System packages, Naming conventions, creating packages, accessing a package, using a package, adding a class to a package.
UNIT – IV

Database and Database users: Introduction, An example, Characteristics of the database approach, Actors on the scene, Workers behind the scene.

Database system concepts and architecture: Database models, Schema and Instances, Three schema architecture and data independence, Database languages and interfaces.

Data Modeling using ER Model: Using High level conceptual data models for database design, Entity types, Entity sets, Attributes and keys, Relationship types, Relationship sets, Roles and structural constraints, Refining the ER design for the company database.

Text 1: 9.5, 10.1-10.4, 11.1-11.8. 11 Hrs
Self Learning Components: Discuss the Accessing interface variables, String buffer class.

UNIT – V

Basics SQL: SQL Data Definition and Data types, Specifying constraints in SQL, Basic Retrieval Queries in SQL, Insert, Delete and Update statements in SQL, More complex SQL retrieval queries.

Relational Model and Relational Database Constraints: Relational Model concepts, Relational data model constraints and relational database schemas, Update operations, Transactions and dealing with constraint violations.

Text 2: 1.1-1.5, 2.1-2.3, 7.1, 7.3, 7.4, 7.6. 11 Hrs
Self Learning Components: Identify the Advantages of using DBMS approach.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:

REFERENCE BOOKS:
ONLINE COURSES AND VIDEO LECTURES:
1. DBMS – SWAYAM - https://nptel.ac.in/courses/106/105/106105175/
2. Java Programming - https://nptel.ac.in/courses/106/105/106105191/

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO#</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO#) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply basic knowledge of programming in understanding concepts and syntax of Java Programming Language</td>
<td>PO1 (L4), PO5 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze concepts and syntax of Java programming in developing Java program solutions to problems,</td>
<td>PO2 (L3), PO5 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>Implement the various concepts of Java features in the development of Java Program.</td>
<td>PO3 (L3), PO5 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Identify the basic concepts and various data model used in database design ER modeling concepts and architecture use.</td>
<td>PO1 (L1), PO5 (L1)</td>
</tr>
<tr>
<td>CO5</td>
<td>Apply relational database theory to Design queries using SQL.</td>
<td>PO3 (L3), PO5 (L3)</td>
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D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the understanding of architecture, programming and interfacing of commercially available Digital Signal Processor.
2. Discuss the effective use of Digital Signal Processor in system implementation.
3. Adopt the MATLAB tools in DSP applications.
4. Provide the understanding of architecture features of TMS320C54XX.
5. Describe the programming of TMS320C54XX for several basic DSP algorithms.
6. Understand the interfacing procedure to use programmable Digital Signal Processor.
7. Discuss the applications of programmable DSP devices.

B. Course Content

UNIT – I

Arichitectures for Programmable DSP Devices: Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.

Text 1: 4.1 to 4.10 10 Hrs

Self Learning Components:
1. Design and implement 8-bit Barrel Shifter using 2:1 Multiplexer in Verilog.
2. Explain pipelining and parallel processing with real life example. Also comment on time requirement in each process.

UNIT – II

Programmable Fixed Point Digital Signal Processors: Introduction, Commercial Digital Signal–processing Devices, Data Addressing Modes of TMS320C54xx DSPs, Data Addressing Modes of TMS320C54xx Processors, Memory Space of TMS320C54xx Processors, Program Control, TMS320C54xx Instructions and programming, On-chip Peripherals, Interrupts of TMS320C54xx Processors, Pipeline Operation of TMS320C54xx Processors.

Text 1: 5.1 to 5.10 10 Hrs

Self Learning Components:
1. How DSP processor is different than conventional processor? Justify your answer with relevant example.
2. Study memory (internal and extended), peripherals and general purpose I/O pins characteristics of 54X processors.
UNIT – III
Implementation of Basic DSP Algorithms: Introduction, the Q– notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID controller, Adaptive Filters, 2–D Signal Processing
Text 1: 7.1 to 7.10 and 8.1 to 8.7 11 Hrs
Self Learning Components:
1. Design and Implement 3-bit Flash analog to digital converter using CMOS technology.
2. Design and implement 4 tap FIR filter using Verilog.

UNIT – IV
Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals, Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I/O, Direct Memory Access (DMA).
Text 1: 9.1 to 9.8 and 10.1 to10.7 11 Hrs
Self Learning Components:
1. Study of Multi-channel Buffered Serial Port.
2. A study of CODEC interfaces circuit and CODEC programming.

UNIT – V
Text 2: 23.1 to 23.7.1, 23.8 10 Hrs
Self Learning Components:
1. Discuss why floating point processor better than fixed point processor.
2. Implement speech processing system using MATLAB.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:

REFERENCE BOOKS:

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO#) with BTL</th>
</tr>
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<tbody>
<tr>
<td>CO1</td>
<td>Distinguish between the DSP Processor and general purpose processor</td>
<td>PO1 (L2)</td>
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<tr>
<td>CO2</td>
<td>Analyze the architecture features of Digital signal processor using basic digital circuit knowledge</td>
<td>PO2 (L1)</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop programs for digital filters using DSP processor for various situations and demonstrate utility of DSP processor in various signal processing applications.</td>
<td>PO4 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Apply the logical and signal processing concepts to develop algorithms for DSP processor.</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td>Design the interface to connect specified memory and signal converters.</td>
<td>PO3 (L5)</td>
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D. Course Articulation Matrix (CAM)

<table>
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<tr>
<th>CO</th>
<th>PO 1</th>
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Professional Elective-I

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<td>Weightage : CIE: 50% SEE: 50%</td>
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A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the knowledge of general architecture of ARM Cortex-M3 processor.
2. Thoroughly discuss the Instruction set of Cortex-M3 processor.
3. Understand Memory system, exceptions and interrupt control.
4. Provide the knowledge of fault interrupt behavior, Cortex-M3 and Exceptions Programming.
5. Provide the knowledge of Advanced Programming Features and System Behavior.

B. Course Content

UNIT – I


Cortex-M3 Basics: Registers, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence.

Text 1: Chapter 1, 2, 3

Self Learning Components:
1. Study the advanced Cortex processors.
2. Discuss the various applications of the ARM Cortex-M processors.

UNIT – II


Text 1: Chapter 4, 10

Self Learning Components:
1. Identify the applications of big endian and little endian processors.
2. Understand how the power management takes place.
UNIT – III

Memory Systems: Memory System Features Overview, Memory Maps, Memory Access Attributes, Default Memory Access Permissions, Bit-Band Operations, Unaligned Transfers, Exclusive Accesses, Endian Mode,


Exceptions: Exception Types, Definitions of Priority, Vector Tables, Interrupt Inputs and Pending Behavior, Fault Exceptions, SVC and PendSV.

Text 1: Chapter 5, 6, 7 11 Hrs

Self Learning Components:
1. Understand the concept of advanced high-performance bus.
2. Identify the difference between LDR and ADR.

UNIT – IV

The NVIC and Interrupt Control: NVIC Overview, the Basic Interrupt Configuration, Interrupt Enable and Clear Enable, Interrupt Pending and Clear Pending, Example Procedures in Setting Up an Interrupt, Software Interrupts, The SYSTICK Timer.


The Memory Protection Unit: Overview, MPU Registers, Setting Up the MPU, Typical Setup.

Other Cortex-M3 Features: The SYSTICK Timer, Power Management, Multiprocessor Communication, Self-Reset Control.

Getting Started with Cortex-M3 Development: Choosing a Cortex-M3 Product, Differences between Cortex-M3 Revision 0 and Revision 1, Development Tools

Text 1: Chapter 8, 9, 13, 14, 17 10 Hrs

Self Learning Components:
1. List the development tools supporting cortex-M3
2. Understand the concept of software interrupts.

UNIT – V


Debug Architecture: Debugging Features Overview, CoreSight Overview, Debug Modes, Debugging Events, Breakpoint in the Cortex-M3, Accessing Register Content in Debug, Other Core Debugging Features

Debugging Components: Introduction, Trace Components: Data Watchpoint and Trace, Trace Components: Instrumentation Trace Macrocell, Trace Components: Embedded Trace Macrocell, Trace Components: Trace Port Interface Unit, The Flash Patch and Breakpoint Unit, The AHB Access Port, ROM Table

Text 1: Chapter 11, 12, 15, 16 10 Hrs
Self Learning Components:
1. Design and Develop ARM processor based real-time car theft decline system.
2. Discuss how the event communication connection takes place in a two-processor system.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:

REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:
1. NPTEL Course by Prof. Indranil Sengupta Dept. of Computer Science and Engineering IIT Kharagpur, https://nptel.ac.in/courses/106/105/106105193/

C. Course Outcomes

<table>
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<tr>
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<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Apply the knowledge of architecture and instruction set of ARM cortex-M3 to develop the program.</td>
<td>PO1 (L2)</td>
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<tr>
<td>CO2</td>
<td>Analyse the ARM processor based programs related to interrupts and exceptions.</td>
<td>PO2 (L2)</td>
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<tr>
<td>CO3</td>
<td>Understand different addressing modes and instructions</td>
<td>PO3 (L1)</td>
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<tr>
<td>CO4</td>
<td>Apply the knowledge gained for Programming ARM Cortex M3 for different applications.</td>
<td>PO3 (L2)</td>
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<tr>
<td>CO5</td>
<td>Design and Develop the embedded systems using the basic knowledge of cortex M3.</td>
<td>PO3, PO5 (L5)</td>
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D. Course Articulation Matrix (CAM)

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P18 Scheme, III Year (V & VI Semester) Syllabus
A. Course Learning Objectives (CLOs)

1. Provide general understanding of adaptive systems
2. Provide mathematical understanding of gradient analysis used with adaptive systems
3. Understand the filter design (Adaptive filters) related to adaptive signal processing
4. Provide understanding of LMS algorithm
5. Introduce different algorithms to implement adaptive signal processing
6. Provide exposure to different applications of adaptive signal processing

B. Course Content

UNIT – I


Properties of Quadratic Performance Surface: Normal Form of Input correlation Matrix, Eigen values and Eigenvectors of the input, correlation matrix, an Example of two weights, Geometrical significance of Eigenvectors and Eigen values, second example

Text 1: Chapter 1, Chapter 2 and Chapter 3 10 Hrs

Self Learning Components: Study and submit the report on

UNIT – II

Searching the Performance Surface: Methods for searching the performance surface, basic Ideas of gradient search Methods, a simple gradient search algorithm and its solution, stability and rate of convergence, Learning curve, gradient search by Newton’s method, Newton’s method in multidimensional space, Gradient search by steepest Descent, Comparison of learning Curves.

Gradient Estimation and Its Effect on Application: Gradient Component Estimation by derivative measurement, Performance penalty, Derivative Measurement and Performance Penalties with multiple weights, Variance of gradient Estimate, effects on the weight vector solution, excess mean square error and time constants Mis-adjustments, competitive performance of Newton’s and Steepest-Descent Methods

Text 1: Chapter 4 and chapter 5 11 Hrs

Self Learning Components:
1. Understand the concepts of the wiener-hopf equation.
2. Analyse the applications of the steepest Descent Algorithm.
UNIT – III

Linear Adaptive Algorithm and Structures: LMS Algorithm-Derivation, Convergence of weight Vector, an example of Convergence, Learning Curve, Noise in Weight-Vector Solution, Mis-adjustments, Performance.


Text 1: Chapter 6 and Chapter 7 11 Hrs

Self Learning Components:
1. Implement the Recursive linear system.
2. Understand and Implement the adaptive traversal filter

UNIT – IV


Text 1: Chapter 8 10 Hrs

Self Learning Components:
1. Comparison of LMS algorithm with the steepest- descent algorithm.
2. List the Applications of LMS algorithm in signal processing.

UNIT – V


Text 1: Chapter 9, 12.5, 12.6, 12.9, 2.11 10 Hrs

Self Learning Component:
1. Analyze the concept of system identification adaptive modeling.
2. Understand the concept of adaptive control systems.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:


REFERENCE BOOKS:


ONLINE COURSES AND VIDEO LECTURES:
1. [https://nptel.ac.in/courses/117/105/117105075/ Lectured](https://nptel.ac.in/courses/117/105/117105075/) by Prof. M. Chakraborty IIT Kharagpur.

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply the basic Knowledge of Mathematics and Signal Processing to understand Adaptive Systems, Algorithms for adaptive systems and applications.</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze Adaptive Systems for their operations and Performance</td>
<td>PO2 (L4)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze and Develop algorithms for adaptive systems</td>
<td>PO2-PO3 (L4, L5)</td>
</tr>
<tr>
<td>CO4</td>
<td>Apply the concepts of Adaptive Signal Processing to analyze and Develop algorithms for adaptive filters</td>
<td>PO1, PO3, (L4, L5)</td>
</tr>
<tr>
<td>CO5</td>
<td>Apply the concepts of adaptive signal processing to real world applications</td>
<td>PO1 (L2)</td>
</tr>
</tbody>
</table>

D. Course Articulation Matrix (CAM)

<table>
<thead>
<tr>
<th>CO #</th>
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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Describe the hardware and software sections of software-defined radio (SDR)
2. Describe the technologies required for cognitive radio and spectrum aware radio.
3. Discuss the fully functional cognitive radio and the intelligent cross-layer optimization of physical (PHY) and link (or medium access control, MAC) layers.
4. Provide the understanding of position and network awareness in cognitive radio.
5. Provide the understanding of the cognitive services for the radio.
6. Describe the radio environment map (REM) and different cognitive radio architectures.

B. Course Content

UNIT – I
Text 1: 3.1-3.7  10 Hrs
Self Learning Component: Study of
1. Comparison between cognitive Radio technologies.
2. The telecommunication policy and technology used in India

UNIT – II
Text 1: 4.1-4.5, 5.1-5.9  10 Hrs
Self Learning Components:
Study and submit the report on:
1. Applications of Cognitive radio Authentication.
UNIT – III


Text 1: 7.1-7.7, 8.1-8.6                                                                                                          11 Hrs
Self Learning Components: Study of
1. Comparison between Geolocation and Network based approaches.
2. The interfaces to other cognitive technologies.

UNIT – IV
Cognitive Techniques-Network Awareness: Introduction, Applications and their Requirements, Network Solutions to Requirements, Coping with the Complex Trade-Space, Cognition to the Rescue, the DARPA SAPIENT Program.

Cognitive Services for the User: Introduction, Speech and Language Processing, Concierge Services.

Text 1: 9.1-9.6, 10.1-10.3                                                                                                      10 Hrs
Self Learning Components: Study of
1. The PDF detection in Cognitive radio Networks
2. The Comparison between Speech and Language Processing

UNIT – V
Network Support the Radio Environment Map: Introduction, Internal and External Network Support, Introduction to the REM, REM Infrastructure Support to Cognitive Radios, Obtaining Awareness with the REM, Network Support Scenarios and Applications, Supporting Elements to the REM.


Text 1: 11.1-11.7, 14.1-14.4                                                                                                   11 Hrs
Self Learning Components: Study of
1. The Building the CRA on SDR architectures.
2. Cognitive electronics

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:
REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:
1. Lecture by Prof. Aditya K Jagannatham IIT Kanpur. https://www.youtube.com/watch?v=SljXFF0vgvw/

C. Course Outcomes

<table>
<thead>
<tr>
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<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply knowledge of electronics and software in understanding Hardware and software architecture of SDR</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Apply the concepts of MODM theory and others to Cognitive radio.</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the functions of different components of Software defined radio in cognitive radio network</td>
<td>PO2 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Design the cognitive radio network using the concepts of physical and link layers as well as position and network awareness</td>
<td>PO3 (L5)</td>
</tr>
<tr>
<td>CO5</td>
<td>Examine the applicability of cognitive radio network to cognitive services such as speech and language processing, concierge services.</td>
<td>PO4 (L4)</td>
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D. Course Articulation Matrix (CAM)

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Laboratory

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<tr>
<td>Weightage</td>
<td>CIE: 50% SEE: 50%</td>
</tr>
</tbody>
</table>

A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the basic knowledge of how to use MATLAB, Simulink, CC studio and TMS32054xx for DSP concepts.
2. Illustrate and Verify fundamental DSP concepts using MATLAB.
3. Understand the usage of recorded real life signals in signal processing.
4. Understanding and dealing with various parameters of noise.
5. Programming of DSP processors.
6. Using of DSP processor for real time signal processing applications.

B. Course Content

1. EXPERIMENTS USING MATLAB/SCILAB/OCTAVE/WAB

1. Computation of the N point DFT of a given sequence and to plot magnitude and phase spectrum.
2. Linear convolution and circular convolution of the two given sequences without using function and using DFT and IDFT.
3. Autocorrelation, Cross correlation of the given sequence and verification of its properties.
4. Plot the spectrum of voice, ECG, EMG and Music.
5. Adding noise of specific mean variance and distribution and add to voice signal and separate using a filter.
6. Solve a given difference equation/system of linear equations using Simulink.
7. Design Filters (FIR and IIR) to meet the given specifications using Simulink.

2. EXPERIMENTS USING DIGITAL SIGNAL PROCESSOR (TMS320C54XX) AND CODE COMPOSER STUDIO (CCS)

(Note: Experiments no. 1, 2 & 3 may be performed on CCS)

1. Linear and Circular convolution of the two given sequences.
2. Computation of the N Point DFT of a given sequence.
3. Realize the FIR filters to meet given specifications. The input can be a signal from function generator/speech signal.
4. Audio applications such as to plot time and frequency (Spectrum) display of Microphone output plus a cosine using DSP. Read a wav file and match with their respective spectrograms.
5. Noise: Add noise above 3 kHz and then remove; Interference suppression using 400 Hz tone.
Open Ended Experiments
1. Interface ECG/EEG signal generator and analyse using DSP processor
2. Analyse the impulse response and step response of a system using MATLAB/SIMULINK
3. Analyse the operation of Basic Communication model using Simulink.

REFERENCE BOOKS:

C. Course Outcomes

<table>
<thead>
<tr>
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<th>Program Outcome Addressed (PO #) with BTL</th>
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<tr>
<td>CO1</td>
<td>Analyze and apply the fundamental DSP concepts using MATLAB</td>
<td>PO1 (L3), PO2 (L3), PO5 (L4)</td>
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<td>CO2</td>
<td>Analyze the recorded real life signals.</td>
<td>PO2 (L3)</td>
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<td>CO3</td>
<td>Analyse various parameters of noise.</td>
<td>PO2 (L3)</td>
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<td>Implement the filters by Interfacing external signal (Biomedical, speech etc) to DSP processor using CCS studio and conduct the experiment in group</td>
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<td>Conduct experiments to verify DSP concepts and applications of DSP using Hardware DSP board</td>
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D. Course Articulation Matrix (CAM)

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P18 Scheme, III Year (V & VI Semester) Syllabus Page 35
Laboratory

Course Title: Analog and Digital Communication Laboratory

<table>
<thead>
<tr>
<th>Course Code: P18ECL57</th>
<th>Semester: V</th>
<th>L-T-P-H : 0-0-3-3</th>
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<td>Weightage: CIE: 50% SEE: 50%</td>
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A. Course Learning Objectives (CLOs)

This course aims to:

1. Provide the basic practical knowledge of Analog and Digital Fiber Optic links, laser, diode characterization and attenuation.
2. Demonstrate the measurement of various parameters of Optical fiber losses, Numerical Aperture and WDM MUX- DEMUX.
3. Demonstrate the generation and detection of analog signals using various modulation techniques such as AM, FM, PAM, PPM.
4. Provide the basic practical knowledge of digital modulation & demodulation.
5. Know the working of DPSK, DPCM, ADPCM, QAM Generation and its detection.
6. Design and Analyze the frequency response of Second order active filters using op-Amp and As table multi-vibrators.

B. Course Content

All the following experiments have to be performed using discrete components and modules.

2. Characterization of WDM MUX and DEMUX.
3. Time Division Multiplexing of signals (Using PAM Kit).
4. Amplitude Modulation and Detection in time domain and its observation in frequency domain (Use Spectrum Analyzer).
5. Frequency Modulation using IC8038/2206 in time domain and in frequency domain.
6. Pulse Position Modulation using IC555 timer
7. Demonstration of ASK, FSK and PSK modulation and Demodulation.
8. Demonstration of DPSK and QAM modulation and Demodulation.
10. Simulation of QPSK transmitter and receiver taking into account the phase and the frequency offset (Using WICOMM–T Kit).
12. Design Second order active filters for different cut-off frequencies using op-Amp: LPF, HPF and BPF.

Open Ended Experiments:

1. Analyse and Understand the Hysteresis Curve generated using Schmitt Trigger Op-amp Circuit.
2. Determine the Bit Error Rate (BER) and analyse the Eye Pattern generated in a Digital Transmission using Light Runner.
3. Design a circuit for Mono-Stable multi-vibrator for a given pulse using MatLab Simulink.
4. Understand the Modulation and Demodulation of Minimum Shift Keying Modulation schemes.
5. Differentiate Delta and Adaptive Delta Modulation techniques.

**REFERENCE BOOKS:**

**C. Course Outcomes**

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<tr>
<th>CO #</th>
<th>Course Outcome</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Understand data transmission in an Optical Analog and Digital Link and Determine attenuation, losses and Numerical Aperture of an optical link.</td>
<td>PO1, PO2, PO9 (L2)</td>
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<tr>
<td>CO2</td>
<td>Analyze by applying basic knowledge of communication theory the working of TDM, ADM, WDM- MUX and WDM-DEMUX.</td>
<td>PO1, PO2, PO9 (L3)</td>
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<td>CO3</td>
<td>Analyze the operation of different Analog and Digital modulation schemes.</td>
<td>PO2, PO4, PO9, P12 (L3)</td>
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<td>CO4</td>
<td>Design and Analyze Second Order Active filters and Multi-vibrator.</td>
<td>PO2, PO3, PO9 (L4)</td>
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<tr>
<td>CO5</td>
<td>Apply knowledge gained with experiments to extend design and conduction of new experiments</td>
<td>PO1 (L4), PO3 (L3), PO12 (L3)</td>
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**D. Course Articulation Matrix (CAM)**

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</table>
Track -1: Embedded Systems and IOT Laboratory

A. Course Learning Objectives (CLO’S)

This course aims to:
1. Understand the basics of programming in C and Embedded C.
2. Understand different properties and capabilities of programming for micro controller implementations.
3. Understand the working and interfaces of an Arduino Micro controller.
4. Understand interface of perform multiple real-time experiments.
5. Understand the overall operation of Automations using controllers.

B. Course Content

1) Introduction to C Programming:
   a) Write a c program function to calculate the sum of two integers where the two integers will be provided by the user.
   b) Write a c program function to calculate the circumference of a circle if the radius of the circle is passed to it.

2) Pointer, Database Management:
   a) Write a C program to return the bigger number between 2 integers using conditional/ternary operator.
   b) Write a C program function to print a half pyramid using *.

3) Understanding the Basics of Arduino Board:
   a) Connect and understand the interface of an Arduino with PC or Arduino IDE.
   b) Verify enabling/disabling of I/O pins on an Arduino Board, Use LEDs to check the status of any Pin.

4) Programming Basics in Arduino:
   a) Write a c program function to take your name as input using fgets stdin and print the name as output on an Arduino IDE.
   b) Write a C program to set the 0th to 3rd bits of an integer, show the same through the LEDs on an Arduino.

5) Sensors and their Integration with Arduino:
   a) Develop a controller system, which can take inputs through various sensors (Gas Sensor, Fire Sensor, IR Sensors & Ultrasonic Sensors) and provide outputs through LED or Buzzers.
6) **Learning to Control a Motor:**
   a) Develop a controller system to control the rotation of a Motor (Simple DC Motors, Stepper Motors).
   b) Interface the Motor Controller or Motor Drivers and Control the operation of a motor.

7) **Establishing Wired/Wireless Communication using Peripherals:**
   a) Develop a controller system to sense a specific data and send the sensed data to the PC through communication module.

8) **Interfacing Different Display or Output Peripherals with Arduino.**
   a) Write a program and develop a controller system, to display environmental temperature.
   b) Develop a controller system to interface 7-Segment Display or QLED to display the A Message.

9) **GSM and Long Range Communication:**
   a) Develop a controller system, to communicate and alert the registered mobile number using GSM module interface.
   b) Develop a controller system to communicate to the host through the use of LoRA gateway.

10) **Learning RFID with Arduino:**
    a) Develop a controller system, which can identify the registered RFID Tags and result in some specific action.

11) **Effectiveness of Arduino for Automation.**
    a) Design a controller system for Home Automation.

**REFERENCE BOOKS:**
Track -2: SystemVerilog Laboratory

A. Course Learning Objectives (CLO’S)

This course aims to:
1. Understand the basics of programming in SystemVerilog.
2. Learn SystemVerilog Constraint Random Verification to verify VLSI designs, usage of SystemVerilog communication features like Semaphores, events and mail boxes.
3. Understand and use the SystemVerilog RTL design and synthesis features.
4. Understand the methods of robust verification.
5. Develop a stimulus generator to create constrained random test stimulus.

B. Course Content

1. Develop a SystemVerilog code to create and maintain a queue/stack with corresponding operations also simulate it as per stated requirements.
2. Using the array data type in SystemVerilog develop a code for ALU as per given specifications and simulate it.
3. Using the Class facility of the SystemVerilog develop a code to simulate and test the operation of a given combinational logic function.
4. Develop a SystemVerilog code to illustrate the concept of Polymorphism.
5. Using function facilities of SystemVerilog develop a code for given arithmetic/logical operation and verify its operation through its test bench simulation.
6. Using task facility of SystemVerilog develop a code to synthesize given logical functionality, verify its operation through test bench and also comment on synthesizability with respect to return type.
7. Using class data types in SystemVerilog develop a code for control register with given specifications and simulate its operation.
8. Develop a SystemVerilog code to illustrate the concept of threads and fork.
9. Develop a SystemVerilog code to illustrate the concept of semaphore.
10. Develop a SystemVerilog code to test the functionality of a given sequential logic circuit.
11. Develop a SystemVerilog code to generate a random test vectors and test given functionality.
12. Using SystemVerilog data types and facilities design and develop synthesizable code for binary search tree.

REFERENCE BOOKS:

Track -3: Java and Web Technologies Laboratory

A. Course Learning Objectives (CLO’S)

This course aims to:
1. To understand object oriented concepts in Java
2. To execute basic SQL queries
3. To develop an ability to design and implement websites with client side scripts, and server side scripting.

B. Course Content

1. Java programs covering object oriented concepts Abstraction, Encapsulation:
   a) Write a Java program to print the result of the following operations.
   b) Write a Java program to display any specific character pattern.

2. Write a Java program to get a number from the user and print whether it is positive or negative.

3. Classes and Objects:
   a) Write a program called Check Pass Fail which prints "PASS" if the int variable "mark" is more than or equal to 50; or prints "FAIL" otherwise. The program shall always print “DONE” before exiting.

4. Write a program called Print Number In Word which prints "ONE", "TWO",... , "NINE", "OTHER" if the int variable "number" is 1, 2,... , 9, or other, respectively. Use
   i) a "nested-if" statement;
   ii) a "switch-case-default" statement.

5. Inheritance, Polymorphism:
   a) Write a class called Square, as a subclass of Rectangle. Convince yourself that Square can be modeled as a subclass of Rectangle. Square has no instance variable, but inherits the instance variables width and length from its superclass Rectangle.

6. Interface and Packages:
   a) Write a program for discount system of a beauty salon, which provides services and sells beauty products. It offers 3 types of memberships: Premium, Gold and Silver. Premium, gold and silver members receive a discount of 20%, 15%, and 10%, respectively, for all services provided (or for similar applications).

7. Write a program for a price calculating system, which provides different pricing depending on the quantity of products purchased: Less than 100 Nos, up-to 500 Nos & more than 500 Nos to give a discount of 10%, 15% and 20% respectively.

8. Programs on HTML5:
   a) Write a java program to develop a single page website (for profile management).

9. Write a java program to develop a website page (an online book store can be chosen as an example) on HTML5.
REFERENCE BOOKS:

C. Course Outcomes

<table>
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<tr>
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<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Ability to understand and verify basic concepts of embedded theory, Java programming and SystemVerilog programming with experimentation</td>
<td>PO1(L1), PO2 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Ability to analyse and discriminate intricacies of embedded theory, Java programming and SystemVerilog programming</td>
<td>PO1(L2), PO2(L4), PO3 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>Ability to use modern tools and get tuned to industrial requirements</td>
<td>PO5 (L2)</td>
</tr>
<tr>
<td>CO4</td>
<td>Will be able to develop small projects through knowledge gained out of practical session</td>
<td>PO2(L4), PO3 (L3)</td>
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<tr>
<td>CO5</td>
<td>Will learn professional ethics, project management capabilities and working in a team</td>
<td>PO8(L2), PO9 (L3)</td>
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D. Course Articulation Matrix (CAM)

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Technical Skills – I

Course Title: Embedded System and IOT

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A. Course Learning Objectives (CLO’S)

This course aims to:
1. Understand the basics of programming in C and Embedded C.
2. Understand different properties and capabilities of programming for micro controller implementations.
3. Understand the specifications and working of Arduino microcontroller.
4. Understand different peripherals interface for multiple real-time experiments.
5. Understand the overall operation of Automations using controllers.
6. Understand different basic programming for IOT applications.
7. Understand the interface of different sensors and signaling peripherals to Arduino & raspberry pi.

B. Course Content

UNIT- I

1. Introduction to C Programming:
   Basics of C-Programming & Embedded C,
2. Pointer, Database Management:
   Use of Pointers, Arrays and Database Management for building different applications using embedded C.
3. Understanding the Basics of Arduino Board:
   Introduction to Arduino Hardware, Understanding different I/O pins, Architecture of Arduino, Arduino IDE.
4. Programming Basics in Arduino:
   Programming Requirements, Use of Conditions, Loops, Timers & Interrupts in Arduino Programming, Pointers, Declaration of I/O pins in Programming
5. Sensors and their Integration with Arduino:
   Introduction to Gas Sensor, Fire Sensor, IR Sensors & Ultrasonic Sensors, Understanding their operations with respect to Arduino.
6. Learning to Control a Motor:
   Types of Motor: Simple DC Motors, Stepper Motors (Servo Motors, Precession Motors), Motor Drivers and their Applications.
7. Establishing Wired/Wireless Communication using Peripherals:
   Connection with PC/Laptop, Bluetooth, Wifi & Zigbee Interfaces for Communication.
8. Interfacing different Display or Output peripherals with Arduino.
   7-Segment Display, LED, LCD & QLED for Arduino.
9. GSM and Long Range Communication:
   Introduction to GSM & LoRA, AT Commands, Interfacing GSM module with Arduino.
10. Learning RFID with Arduino:
    Introduction to RFID, Active & Passive RFID, RFID frequencies and protocols.
11. Effectiveness of Arduino for Automation.


REFERENCE BOOKS:

C. Course Outcomes

<table>
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<tr>
<th>CO #</th>
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<th>Program Outcome Addressed (PO #) with BTL</th>
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<td>CO1</td>
<td>Understand the concepts of Programming in C and Embedded C.</td>
<td>PO1, PO3 (L1)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the implementations of Embedded Processors (Arduino) with different peripherals.</td>
<td>PO1, PO2, PO3 (L2)</td>
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<td>CO3</td>
<td>Illustrate the Embedded Systems (Arduino Microcontrollers) for simple automations.</td>
<td>PO1, PO3 (L2)</td>
</tr>
<tr>
<td>CO4</td>
<td>Explore and understand modern tools both hardware and software used with Embedded Technology and IOT.</td>
<td>PO1, PO2, PO5 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the capability to learn on your own individually and in group to explore advanced technologies in Embedded system and IOT.</td>
<td>PO9, PO12 (L4)</td>
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D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLO’S)

This course aims to:

1. Develop an understanding of the SystemVerilog language constructs.
2. Introduce the facilities and features of SystemVerilog for unified Design, testing and verification.
3. Introduce the programming approach for testing and verification.

B. Course Content

Module 1-Part -1: Data Types
Built-in Data Types, Fixed-Size Arrays, Dynamic Arrays, Queues, Associative Arrays, Linked Lists, Array Methods, Choosing a Storage Type.
Text 1: 2.1-2.7.

Module 1-Part -2: Data Types
Creating New Types with typedef, Creating User-Defined Structures, Enumerated Types, Constants, Strings, Expression Width.
Text 1: 2.8-2.16.

Module 2: Procedural Statements and Routines
Introduction, Procedural Statements, Tasks, Functions, and Void Functions, Task and Function Overview,
Routine Arguments, Returning from a Routine, Local Data Storage, Time Values.
Text 1:3.1-3.7.

Module 3: Basic OOPs - Part-1
Your First Class, Where to Define a Class, Creating New Objects, Object De allocation, Using Objects, Class methods, Defining methods outside of the class.
Text 1: 5.3-5.10.

Module 4: Basic OOPs - Part-2
Static Variables vs. Global Variables, Scoping Rules, Using One Class Inside Another, Understanding Dynamic Objects, Copying Objects, Public vs. Private Straying Off Course, Building a Testbench.
Text 1: 5.11-5.18.
Module 5: Randomization and Constraints - Part-1

Module 6: Randomization and Constraints - Part-2
The pre_randomize and post_randomize Functions, Random Number Functions, Constraints Tips and Techniques, Common Randomization Problems.
Text 1: 6.9-6.12.

Module 7: Randomization and Constraints - Part-3
Iterative and Array Constraints, Atomic Stimulus Generation vs. Scenario Generation, Random Control, Random Number Generators, Random Device Configuration.

Module 8: Threads and Inter Process Communication
Working with Threads, Disabling Threads, Interprocess Communication, Events, Semaphores, Mailboxes, Building a Testbench with Threads and IPC.
Text 1: 7.1-7.7.

Module 9: Functional Coverage - Part-1
Gathering Coverage Data, Coverage Types, Functional Coverage Strategies, Simple functional Coverage examples, Anatomy of a cover group, triggering a cover group.

Module 10: Functional Coverage - Part-2
Data Sampling, Cross coverage, Generic cover groups, Coverage Options, Analyzing Coverage Data, Measuring Coverage Statistics during simulation.

TEXT BOOK:

REFERENCE BOOK:
C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td><strong>Understand</strong> the SystemVerilog language constructs.</td>
<td>PO1, PO2, PO3 (L1)</td>
</tr>
<tr>
<td>CO2</td>
<td><strong>Understand</strong> the SystemVerilog OOPs facilities and framework for the verification.</td>
<td>PO2, PO3 (L1)</td>
</tr>
<tr>
<td>CO3</td>
<td><strong>Develop</strong> programs by applying the SystemVerilog facilities and framework.</td>
<td>PO1, PO3, PO4 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Explore and <strong>understand modern software tools</strong> to perform different operations in SystemVerilog.</td>
<td>PO1, PO2, PO5 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td><strong>Develop</strong> the capability to learn on your own individually and in group to explore advanced technologies in SystemVerilog.</td>
<td>PO9, PO12 (L4)</td>
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</table>

D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLO’S)

This course aims to:
1. To understand object oriented concepts in Java
2. To execute basic SQL queries
3. To develop an ability to design and implement websites with client side scripting, and server side scripting.

B. Course Content

Week 1 and 2: Java programs covering object oriented concepts Abstraction, Encapsulation, Classes and Objects

Week 3 and 4: Java programs covering Inheritance, Polymorphism, Interface and Packages

Week 5 and 6: Programs on HTML5 and CSS

Week 7: Executing basic SQL queries: Insert, Delete, Search, Update

Week 8 and 9: Programs on Java Script

Week 10, 11 and 12: PHP programs

(Week 5 onwards a simple web application like an online book store can be chosen as an example to write programs on HTML5, CSS, Java Script, PHP. MySQL can be used as database management system).

REFERENCE BOOKS:

C. Course Outcomes

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<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td><strong>Implement</strong> object oriented concepts in Java.</td>
<td>PO1, PO3 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td><strong>Design and Implement</strong> websites with client side scripting using Java script.</td>
<td>PO1, PO2, PO3, PO5 (L3)</td>
</tr>
<tr>
<td>CO3</td>
<td><strong>Understand</strong> the <strong>modern software tools</strong> like HTML5, CSS for advanced web developments.</td>
<td>PO1, PO3, PO5, PO12 (L1)</td>
</tr>
<tr>
<td>CO4</td>
<td><strong>Design and Implement</strong> websites and connect to database with server side scripting using PHP.</td>
<td>PO1, PO2, PO5 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td><strong>Develop</strong> the capability to learn on your own individually and in group to explore advanced technologies in SQL, HTML5, CSS &amp; PHP.</td>
<td>PO9, PO12 (L4)</td>
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D. Course Articulation Matrix (CAM)

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</table>
Prerequisites: Vocabulary builder, Concept of Percentage.

A. Course Learning Objectives (CLO’S)

This course aims to:

1. Describe the importance of reading with comprehension.
2. Explain seven dimensions approach to better reading skills.
3. Explain the purpose, plan and the ways to identify specific details in a paragraph for better comprehension.
4. Formulate easier ways to solve problems of averages.
5. Explain the Application of the technique of allegation while solving weighted average and mixture problems.
6. Describe the concepts of profit, loss, discount, marked price.
7. Explain the application of percentage in our daily life.
8. Discover different ways to identify the progressions and to compare between AP< GP and HP.
9. Explain the basic concepts in calculating simple interest and compound interest.
10. Differentiate between simple interest and compound interest and describes the importance of compound interest and its behavior.

B. Course Content

UNIT- I

Reading Comprehension: Introduction: Read more and more, the process of writing and its relevance to the process of writing, how reading skills are important for aspects other than the reading comprehension questions, the daily reading scheme.

Seven Dimension Approach to Better Reading Skills: Developing the ability of understanding vocabulary in context, Ability to identify and understand main ideas, Ability to predict and identify supporting details, Understanding the use of transition and idea organization patterns, Inferences, Identifying purpose and tone, Recognizing and evaluating arguments and their common structures.

Theory of Reading Comprehension: Solving RC passages is an exact science, tackling RC on the basis of evaluation of support, All passages have a topic, purpose and a plan, Other things to pick up while reading the passage- The tonality and other software related the author’s viewpoint in the passage, specific details and their use in the passage, Types of questions asked in reading comprehension passage.

UNIT - II

Averages and Alligations Mixtures: Average: relevance of average, meaning of average, properties of average, deviation method, concept of weighted average. Alligation Method: situation where allegation technique, general representation of alligations, the straight line approach, application of weighted average and allegation method in problems involving mixtures. Application of alligation on situation other than mixtures problems.
UNIT - III

Permutation and Combination: Understanding the difference between the permutation and combination, Rules of Counting-rule of addition, rule of multiplication, factorial function, Concept of step arrangement, Permutation of things when some of them are identical, Concept of $2^n$, Arrangement in a circle.

UNIT - IV

Progression: Arithmetic Progression: sum of given number of terms in an A.P., arithmetic mean, to insert a given number of arithmetic means between two given quantities, nth term of an A.P., finding common difference of an A.P. given 2 terms of an A.P., types of A.P.s— increasing A.P.s and decreasing A.P.s

Geometric: to find, the geometric mean between two given quantities, to insert a given number of geometric means between two given quantities, sum of a number of terms in a G.P. Types of G.P.s— increasing G. P. s type one and two, decreasing G. P. s type one and two.

Harmonic Progression: to find the harmonic mean between two given quantities, theorems related with progressions, solved examples sample company questions.

UNIT - V

Coding Decoding: Letter Coding, Number coding, symbol coding

Crypt arithmetic: Basic concepts, addition, subtraction, multiplication of coded alphabets, Types of cryptarithmetic.

Data Interpretation: Approach to interpretation - simple arithmetic, rules for comparing fractions, Calculating (approximation) fractions, short cut ways to find the percentages, Classification of data— Tables, Bar graph, line graph, Cumulative bar graph, Pie graph, Combination of graphs. Combination of table and graphs.

REFERENCE BOOKS:
3. “Quantitative Aptitude” by Dr. R. S Agarwal, published by S. Chand private limited. ISBN: 9788121924986, 9788121924986, 2018
### C. Course Outcomes

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<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Apply the approach of seven dimensions to better reading skills.</td>
<td>PO8 (L2)</td>
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<tr>
<td>CO2</td>
<td>Solve the questions under reading comprehension confidently with higher accuracy than random reading</td>
<td>PO7, PO8 (L4)</td>
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<tr>
<td>CO3</td>
<td>Apply the technique of allegation for effective problem solving.</td>
<td>PO3(L2)</td>
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<td>CO4</td>
<td>Interpret the requirement of different methods of calculating average and apply the right method at right scenario.</td>
<td>PO1, PO8 (L4)</td>
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<tr>
<td>CO5</td>
<td>Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest.</td>
<td>PO1, PO8 (L5)</td>
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<td>CO6</td>
<td>Formulate the equations for summation and other functions for all the kinds of progressions– AP, GP and HP.</td>
<td>PO1 (L1)</td>
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### D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Describe the basic MOS device physics and models.
2. Describe method of the small signal and large signal analysis of amplifiers.
3. Understanding the working of single stage MOS amplifiers with analysis.
4. Describe the operation of different types of Current mirrors and their applications.
5. Analysis and Design of the Operational amplifiers.
6. Analyse and design of CMOS oscillators with mathematical model of VCOs.

B. Course Content

UNIT – I


Text 1: 2.4, 3.1 to 3.5 and 4.1 to 4.3

Self Learning Component: Design and simulate a single stage/differential amplifier for given requirements across different technologies, note the limitations and benefits.

UNIT – II


Text 1: 4.4 to 4.5 and 5.1 to 5.3

Self Learning Component: Explore and analyze the Wilson Current mirror.

UNIT – III

Frequency Response of Amplifiers: General Considerations: Miller Effect, Association of Poles with Nodes, Common source stage, Source Followers, Common-Gate Stage, Cascade Stage and Differential Pair.

Text 1: 6.1-6.6

Self Learning Component: Study and understand the procedure of calculating Network functions along with the analysis of its Poles and Zeros (Ref: Ch.10 of Network Analysis, 3rd edn, M.E. Van Valkenburg, PHI.)
UNIT – IV

Operational Amplifiers: General considerations, One stage op-amp, Two stage op-amp, Gain Boosting, Comparison, Common Mode feedback, Input Range limitations, Slew rate, Power supply rejection, Noise in Op-amps.

Text 1: 9.1 to 9.9 10 Hrs


UNIT – V

Noise: Statistical characteristics of noise, Types of Noise, Representation of Noise in Circuits, Noise in single stage amplifiers: Common Source stage. Oscillators: General Considerations, Ring Oscillators, LC Oscillators, Voltage–Controlled Oscillators, Mathematical Model of VCOs.

Text 1:14.1 to 14.5 10 Hrs

Self Learning Component: Read and explore the Qualcomm VCO design.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:


REFERENCES BOOK:


ONLINE COURSES AND VIDEO LECTURES:

1. https://nptel.ac.in/courses/117/101/117101105/ (By Prof. A N Chandorkar, IIT, Bombay)

2. https://nptel.ac.in/courses/108/106/108106105/ (By Prof. Aniruddhan S, IIT, Madras)

3. https://swayam.gov.in/ndl_noc20_eel13/preview (By Prof. Hardik Jeetendra Pandya, IISC, Bengaluru)
C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
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<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>To Apply the knowledge of circuit elements and circuit analysis to understand the MOS devices and analog CMOS circuits</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>To Analyze different Analog CMOS VLSI circuits (Amplifiers, Op-amps, Oscillators)</td>
<td>PO2 (L4)</td>
</tr>
<tr>
<td>CO3</td>
<td>To Design the analog CMOS circuits for the given Specifications.</td>
<td>PO3 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>To Develop analog CMOS circuits for Different applications.</td>
<td>PO3 (L5)</td>
</tr>
<tr>
<td>CO5</td>
<td>To Simulate the analog CMOS circuits using modern tools.</td>
<td>PO5, PO9 (L5)</td>
</tr>
</tbody>
</table>

D. Course Articulation Matrix (CAM)

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Course Title: Control Systems (CC-2)

Course Code: P18EC62  Semester: VI  L-T-P-H: 4-0-0-4  Credits: 4
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs.  Weightage: CIE: 50%  SEE: 50%

A. Course learning Objectives (CLOs)

This course aims to:
1. Determine the mathematical transfer function models of electrical system, mechanical system and analogous system.
2. Determine the transfer function from the block diagrams and signal flow graph techniques of different system.
3. Analyze the performance of different systems by determining the time Response specifications.
4. Analyze the stability of different systems by analytical and graphical means.(By sketching plots)
5. Discuss the concepts of state models for different electrical systems.

B. Course Content

UNIT – I
Fundamental Concepts of Control Systems: Basic definitions of control systems, Classification, Open loop and closed loop systems,
Modeling of Systems: Differential equations of physical systems, Determinations of transfer function models for Electrical, Mechanical and Analogous systems.
Block Diagrams and Signal Flow Graphs: Transfer functions, Block diagram algebra, Signal Flow graphs (State variable formulation excluded).
Text 1: 1.1, 2.1, 2.2, 2.4, 2.5, 2.6, 2.7.  10 Hrs
Self Learning Component:
1. Develop the Block diagram for field and armature controlled D.C. Servomotors.
2. Develop the system equations and TF model for a seated human body with applied force.

UNIT – II
Time Domain (Transient and Steady State Response) Analysis of Feedback Control Systems: Standard test signals, Unit step response of First and second order systems.
Time Response Specifications: Transient response specifications of second order systems, steady state errors and static error constants.
Text 1: 2.4, 2.5, 2.6, 2.7, 5.1, 5.2, 5.3, 5.4, 5.5  10 Hrs
Self Learning Component:
1. Determine the transient response specifications of second order RLC systems for R=1000 ohms, L=1 Henry and C=2µF.
UNIT – III

Stability Analysis: Concepts of stability, asymptotic stability, necessary conditions for stability, Routh-Hurwitz stability criterion, Routh’s tabulation, special cases when Routh’s tabulation terminates prematurely.

Root Locus Techniques: The root locus concepts, summary of general rules for constructing Root Loci, Stability analysis.

Text 1: 6.1, 6.2, 6.4, 6.5, 6.6, 7.1, 7.2, 7.3 10 Hrs

Self Learning Component:
1. Write the MATLAB program to draw the Root Locus diagrams of open loop transfer function of different systems. (Refer Text 2)

UNIT – IV

Frequency-Response Analysis: Introduction, advantages and limitations of frequency domain methods, correlation between time response and frequency response, frequency response specifications- resonant peak, resonant frequency and bandwidth.

Graphical Analysis of Frequency –Response:
(i) Bode Plots
Gain margin, Phase Margin and discuss the stability, Relative stability analysis.
(ii) Polar plots
Gain margin and Phase Margin and discuss the stability. (iii) Nyquist plots
Pole-zero configurations, concept of encirclement, analytical function and singularities, mapping theorem, Nyquist stability criteria, and determination of stability from the Nyquist plot.

Text 1: 8.1, 8.2, 8.4, 8.5, 8.6, 9.1, 9.2, 9.3, 9.4. 12 Hrs

Self Learning Component:
1. Write the MATLAB program to draw the Bode diagrams of open loop transfer function of different systems. (Refer Text 2)

UNIT – V

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Controllability and observability, Derivation of transfer functions from the state model, Solution of state equations.

Text 1: 12.1, 12.2, 12.3, 12.6, 12.7 10 Hrs

Self Learning Component:
1. Obtain the time response for different state models

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:
REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:
1. NPTEL course on “Introduction to System and Control” by Prof Ramakrishna Pasumarthy, IIT Madras https://nptel.ac.in/courses/108/106/108106098/

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Apply mathematical knowledge to determine the Transfer function of a system</td>
<td>PO1(L3)</td>
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<tr>
<td>CO2</td>
<td>Analyze the stability of a system using different techniques</td>
<td>PO2(L4)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the response of the system in time and frequency domain and state variable techniques</td>
<td>PO2(L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop the mathematical models using different techniques of state variables</td>
<td>PO2(L4)</td>
</tr>
<tr>
<td>CO5</td>
<td>Design Using MATLAB software for the linear control system problems.</td>
<td>PO4, PO9(L5)</td>
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D. Course Articulation Matrix (CAM)

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Page 58
Course Title: **Microwaves and Antennas (CC-3)**

<table>
<thead>
<tr>
<th>Course Code: P18EC63</th>
<th>Semester: VI</th>
<th>L-T-P-H: 4-0-0-4</th>
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<td>Weightage: CIE: 50%</td>
<td>SEE: 50%</td>
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**A. Course Learning Objectives (CLOs)**

This course aims to:
1. Provide the basic knowledge of Microwave transmission lines and planar transmission lines.
2. Discuss the working of Microwave waveguides, microwave IC’s, active and passive Devices.
3. Solve the numerical Problems on Microwave transmission lines and devices.
4. Provide the understanding of concepts of types of antenna and parameters of antenna.
5. Discuss the field due to dipole antenna and array of antenna.
6. Describe the structure and working of helical, log-periodic and microstrip antennas.
7. Solve the numerical Problems on antenna parameters and arrays.
8. Design the helical, log-periodic and microstrip antennas.

**B. Course Content**

**UNIT – I**

**Microwave Transmission Lines:** Introduction, transmission lines equations, characteristic and input impedances, reflection and transmission coefficients, standing waves, mismatch losses in transmission lines, rectangular waveguides, TE and TM wave solutions, dominant and degenerate modes, planar transmission lines, strip lines.

**Microwave Integrated Circuit Manufacturing:** Introduction, types of MICs and their technology, hybrid technology, thick-film manufacture, thin-film manufacture.

Text 1: 3.1- 3.6, 3.10, 3.10.1, 3.11 - 3.11.4, 4.1, 4.2, 4.3, 4.3.1, 4.3.2. 11 Hrs

**Self Learning Components:**
1. Micro strip lines.
2. Smith Chart.

**UNIT – II**

**Microwave Passive Devices:** Attenuators, phase shifters - precision phase shifter, MIC phase shifter, reciprocal and non-reciprocal phase shifter, waveguide tees, E-plane tee, H-plane tee, hybrid or magic tee, Directional couplers- waveguide directional coupler and Bethe-hole coupler (excluding all other types of couplers)

**Microwave Solid State Devices:** Transferred electron devices (TED) - Gunn diodes, gunn diode oscillator, avalanche transit time devices (ATTD), IMPATT diodes, DC operating principles, mechanism of oscillations, IMPATT diode power amplifier, TRAPATT diodes, BARITT diodes, tunnel diodes.

Text 1: 6.4.14, 6.4.15, 6.4.16, 6.4.18, 10.3-10.5 10 Hrs

**Self Learning Components:**
Applications of microwaves:
1. Industrial application of microwaves- Microwave ovens, Industrial control and measurements- thickness measurements, moisture content measurements.
2. Medical applications- microwave diathermy.
UNIT – III


Text 2: 1.1, 1.2, 1.3 – (1.3.1, 1.3.2, 1.3.3), 2.1 to 2.5, 2.7 to 2.11, 2.14 11 Hrs

Self-Learning Components:
1. Linear, Circular and Elliptical Polarization

UNIT – IV


Antenna Arrays: Introduction, Two- Element Array, N-Element Linear Array – Uniform Amplitude and Spacing, Directivity.

Text 2: 4.1, 4.2, 6.1, 6.2, 6.3 - 6.3.1 to 6.3.3, 6.4 -6.4.1, 6.4.2. 10 Hrs

Self-Learning Components:
1. Planar Array: Array Factor, Beamwidth, Directivity
2. Hansen- Woodyard End-Fire array

UNIT – V


Text 2:10.3 - 10.3.1, 11.1, 11.2, 11.4, 14.1, 14.2 – 14.2.1 10 Hrs

Self Learning Components:
1. Yagi-Uda Antenna – Design Concepts

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:
REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:

C. Course Outcomes

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<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Apply the knowledge of mathematics and EM fields to understand the parameters, field due to antennas, properties of microwave devices and transmission lines</td>
<td>PO1 (L3)</td>
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<tr>
<td>CO2</td>
<td>Analyse the working and performance of microwave transmission lines, microwave IC’s and antennas Applying basic concepts of Microwave theory</td>
<td>PO1, PO2 (L4)</td>
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<tr>
<td>CO3</td>
<td>Examine the working and performance of microwave sources, microwave transmission line and different types of antennas.</td>
<td>PO2 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Analyse the working and performance of microwave devices and antenna arrays.</td>
<td>PO2 (L4)</td>
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<tr>
<td>CO5</td>
<td>Design of helical, log-periodic and micro strip antennas.</td>
<td>PO3 (L4)</td>
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D. Course Articulation Matrix (CAM)

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</tbody>
</table>
A. Course Learning Objectives (CLOs)

1. Explain the types of multimedia network and its applications.
2. Describe the digitization principles of text and images.
3. Provide the understanding of digitization techniques of audio and video.
4. Discuss the compression techniques of different media types.
5. Describe the standards related to multimedia communication.
6. Discuss the applications of Cloud Computing for Multimedia Services.

B. Course Content

UNIT-I
Multimedia Communications: Introduction, Multimedia information representation, Multimedia networks: Telephone, data, Broadcast television, ISD and Broadband multiservice digital networks, Multimedia applications: Interpersonal communication, Interactive application over the internet, Entertainment applications, Application and networking terminology: Media types, Communication modes, Network types, Network QoS and Application QoS.

Text 1: 1.1 to 1.5                                10 Hrs
Self Learning Component:
1. Multimedia Electronic mail structure,
2. Transmission of a constant bit rate stream over packet-switched networks.

UNIT – II

Text 1: 2.1 to 2.6                                10 Hrs
Self Learning Component:
1. Digital cameras and scanners,
2. CD-quality audio and Synthesized audio,
3. HDTV formats, PC video and video content.

UNIT – III
Text and Image Compression: Introduction, Compression principles: Source encoders and destination decoders, Lossless and lossy compression, Entropy encoding, Source encoding, Text compression: Static Huffman coding, Dynamic Huffman coding, Arithmetic coding, Image compression: GIF, TIFF, JPEG.

Text 1: 3.1 to 3.4 and 4.1 to 4.3

Self Learning Component:
2. Image: Digitized documents, Digitized pictures
3. Audio: code-excited LPC and perceptual coding
4. Video: H.263.

UNIT – IV


Text 1: 5.1, 5.3 to 5.5

Self Learning Component:
1. TCP/IP reference model,
2. Java and JavaScript

UNIT – V

Multimedia Information sharing and Retrieval: Representative Social Media Services, User-Generated Media content Sharing, Media Propagation in Online Social Networks.


Text 2: 18.1 to 18.3 and 19.1-19.5.

Self Learning Component:
1. Enhancing UGC video sharing,
2. Video Streaming and Inline Storage
3. Cloud-Assisted Motion Estimation.

Case Studies:
1. Investigate effective factors on multimedia advertising: A case study of online Advertising.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)
TEXT BOOK:

REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:
1. NPTEL video lecturing on “Multimedia Processing (Web)”, Co-ordinated by IIT Kharagpur. Link - https://nptel.ac.in/courses/117/105/117105083/#

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Compare different networks in Multimedia Communication and its applications.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Apply the basic knowledge of digital data processing and representation to Analyze Multimedia information.</td>
<td>PO1, PO2 (L3)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyse various compression techniques for different media types and design algorithms</td>
<td>PO2, PO3 (L3)</td>
</tr>
<tr>
<td>CO4</td>
<td>Inspect the various standards used in multimedia applications.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyse cloud sharing and retrieval of multimedia information.</td>
<td>PO2 (L2)</td>
</tr>
</tbody>
</table>

D. Course Articulation Matrix (CAM)

<table>
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<tr>
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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Describe the basic Radar operation, detection of echo signal and radar applications.
2. Discuss different radar range equations and calculate the effect of various external / internal factors on radar accuracies.
3. Explain the idea behind MTI and radar tracking systems.
4. Examine the different technologies for Detection of targets.
5. Explain different Clutters that affects the detection of radar signals.
6. Discuss the different radar transmitters and receivers.
7. Explain different navigational aids.

B. Course Content

UNIT – I


Text 1: 1.1 to 1.5, 2.1 to 2.3, 2.5, 2.7. 11 Hrs

Self Learning Components:
1. Applications of modern radar systems.
3. MIT Lincoln Laboratory- Introduction to Radar Systems – Lecture 1 – Introduction; Part 1 https://www.youtube.com/watch?v=Hw5IaS6-Fzw

UNIT – II


Text 1: 3.1, 3.2, 3.5 to 3.7, 4.1 to 4.3. 10 Hrs

Self Learning Components:
1. Limitations to tracking accuracy
UNIT – III
Text 1: 5.1 to 5.5, 7.1 to 7.4, 7.6. 10 Hrs
Self Learning Components:
1. Detection of targets in clutter

UNIT – IV
Radar Transmitter: Introduction, linear beam power tubes, solid state RF power sources, cross field amplifiers. Radar Receiver: Radar noise figures, Super-heterodyne receiver, Duplexers and receiver protectors, Radar displays.
Text 1: 10.1 to 10.3, 10.5, 11.1 to 11.5. 10 Hrs
Self Learning Components:
1. Other RF Power Sources

UNIT – V
Text 2: 14.1 to 14.10, 15.1, 17.3. 11 Hrs
Self Learning Components:
1. Differential Global Positioning System (DGPS)

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:


REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:

1. NPTEL Course on Principles and Techniques of Modern Radar Systems by Dr. Amitabha Bhattacharya, IIT Kharagpur  Link:- [https://nptel.ac.in/courses/108/105/108105154/](https://nptel.ac.in/courses/108/105/108105154/)

C. Course Outcomes

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</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply the basics of electromagnetic field theory and mathematics concepts to understand the working of different radars, Tracking systems and Factors affecting radar system.</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analysis of Radar Equations, different types of Radar systems and Tracking systems.</td>
<td>PO1, PO2 (L3)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the effect of various external / internal factors on Radar and its trans-reception.</td>
<td>PO1, PO2 (L2)</td>
</tr>
<tr>
<td>CO4</td>
<td>Analysis of radar applications for different target detections.</td>
<td>PO1, PO2 (L4)</td>
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<tr>
<td>CO5</td>
<td>Analyze the concept of Navigation and Positioning Aids.</td>
<td>PO1, PO2 (L3)</td>
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D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Understand the principles of multifunctional computer arithmetic and logical operations.
2. Provide an overview of the Operating Systems topics.
3. Examine the issues of mutual exclusion and deadlock.
4. Impart a thorough understanding of linear data structures such as stacks, queues and their Applications.
5. Impart a thorough understanding of non-linear data structures such as trees, graphs and their Applications along with various sorting, searching and hashing techniques.

B. Course Content

UNIT – I


Text 1: Ch 2: 2.1, Ch 6: 6.1 to 6.7

Self Learning Components:
1. Simulating Fast adders by using any simulator

UNIT – II


Text 2: 2.1-2.6, 3.1-3.5

Self Learning Components:
1. Discuss the objectives and functions of operating system.
2. Understand the Android software Architecture.

UNIT – III

Concurrency: Mutual Exclusion and Synchronization - Principles of Concurrency, Mutual Exclusion: Hardware Support, Semaphores, Monitors, Message Passing, Readers/Writers Problem.


Memory Management: Memory Management Requirements, Memory Partitioning, Paging SEGMENTATION

Text 2: 5.2 - 5.7, 6.1 - 6.6, 7.1-7.4
Self Learning Components:
1. Understand the importance of concurrency in a single-processor multiprogramming system.
2. Discuss Fixed partitioning and Dynamic partitioning memory partition.
3. Learn how Data Structures used in Online Ticket Booking, Music Player, Web Browser & in Google Map. [https://www.youtube.com/watch?v=d_XvF0kQz5k](https://www.youtube.com/watch?v=d_XvF0kQz5k)

UNIT – IV
Basic Concepts: Pseudocode, The Abstract Data Type, Model for an Abstract Data Type, ADT Implementations.
Stacks: Basic Stack Operations, Stack Linked List, C Language Implementations, Stack ADT.
Queues: Queue Operations, Queue Linked List Design, Queuing Theory.
Text 3: Chapter 1(1.1 - 1.4), Chapter 3 (3.1 – 3.4), Chapter 4 (4.1 - 4.2, 4.4) 10 Hrs
Self Learning Components:
1. Discuss stack ADT implementation.
2. List the applications of Queuing theory in data structures.
3. NPTEL- Data Structures and Algorithms- [https://www.youtube.com/watch?v=zWg7U0OEaOE&list=PLBF3763AF2E1C572F](https://www.youtube.com/watch?v=zWg7U0OEaOE&list=PLBF3763AF2E1C572F)

UNIT – V
Introduction to Trees: Basic Tree Concepts, Binary Trees, General Trees.
Binary Search Trees: Basic Concepts, BST Operations.
Searching: List Searches: Search Implementations.
Text 3: Chapter 6 (6.1 – 6.3), Chapter 7 (7.1 – 7.3), Chapter 12 (12.1 – 12.3), Chapter 13 (13.1 – 13.2) 11 Hrs
Self Learning Components:
1. Understand the applications of Binary Search Tree.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:

REFERENCE BOOKS:
ONLINE COURSES AND VIDEO LECTURES:
1.  NPTEL- Computer Organization and Architecture A Pedagogical Aspect- by Prof. Arnabsarkar et.al IIT Guwahati [https://www.youtube.com/watch?v=msqxkEKFg8I&list=PLgHucKw979AvcnTpPNZMZYORdL5HvTr9m]
2.  Operating System Fundamentals by Prof. Santanu Chattopadhyay, IIT Kharagpur [https://nptel.ac.in/courses/106/105/106105214/]
3.  Programming, Data structures and Algorithms by Dr. N S. Narayanaswamy et.al, IIT Madras [https://nptel.ac.in/courses/106/106/106106133/]

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Will be able to formulate computer arithmetic and understand the performance requirements of systems</td>
<td>PO1, (L1), (L2)</td>
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<tr>
<td>CO2</td>
<td>Will understand the functions and objectives of operating system</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>Will be able to identify the problems related to task synchronization and deadlock</td>
<td>PO2 (L2)</td>
</tr>
<tr>
<td>CO4</td>
<td>Will use appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.</td>
<td>PO2, PO3, (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td>Will be able to represent and manipulate data using nonlinear data structures like trees to design algorithms for various applications.</td>
<td>PO2 (L2)</td>
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D. Course Articulation Matrix (CAM)

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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the basic knowledge of VLSI Testing and Verification.
2. Provide the understanding of Test Generation for Combinational Logic Circuits.
3. Design a Testable Combinational Logic Circuits and Sequential Circuits.
4. Explain the concept of Verification Tools and Verification languages.
5. Outline the concepts of waveform generation and test benches.

B. Course Content

UNIT - I

Faults in Digital Circuits: Failures and Faults, Modeling of Faults: Stuck at Faults, Bridging Faults, Breaks and transistor Stuck–On/Open Faults in CMOS, Delay Faults.


Text 1:1.1, 1.2, 2.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4 10 Hrs

Self Learning Components: Temporary Faults, FAN, Delay Fault detection.

UNIT - II


Test Generation for Sequential Circuits: Testing of Sequential Circuits as Iterative Combinational Circuits, State Table Verification, Test Generation Based on Circuit Structure,

Text1:3.1, 3.2, 3. 3, 3. 5, 3.7, 4.1, 4.2, 4. 3 11 Hrs


UNIT- III

Design of Testable Sequential Circuits: Controllability and Observability, Ad Hoc Design Rules for Improving Testability, The Scan-Path Technique for Testable Sequential Circuit Design, Level-Sensitive Scan Design, Boundary Scan.

Built-In Self Test: Test Pattern Generation for BIST, Output Response Analysis, BIST Architectures.

Text 1: 5.1, 5.2, 5.4, 5.5, 5.10, 6.1, 6.2, 6.4 11 Hrs

Self Learning Components: Design of Diagnosable Sequential Circuits, Random Access Scan Technique, Cross Talk, Circular BIST.
UNIT - IV

What is verification: What is testbench, Importance of verification, Reconvergence model, Human factor, what is being verified.


Text 2: Chapter-1, Chapter-2  10 Hrs

Self Learning Components: Functional verification approaches, Third party models, Revision Control.

UNIT - V


Text 2: Chapter -5  10 Hrs

Self Learning Components: Predicting the output: Data Formatters, Packet Processors, Complex Transformations.

Case Study:
- VLSI Testing (http://www.ee.ncu.edu.tw/~jfli/vlsi21/lecture/ch06.pdf)
- https://nptel.ac.in/courses/106/103/106103116/

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:


REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:

1. NPTEL Course on Design Verification and test of Digital VLSI circuits, by Dr Santhosh Biswas and Dr Jitendra Kumar Deka, IIT Guhath, https://nptel.ac.in/courses/106/103/106103116/

C. Course Outcomes

<table>
<thead>
<tr>
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<th>Program Outcome Addressed (PO #) with BTL</th>
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<tr>
<td>CO1</td>
<td><strong>Apply</strong> the knowledge of Digital and Analog VLSI circuits to understand the concepts of VLSI Circuit testing.</td>
<td>PO1 (L2)</td>
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<tr>
<td>CO2</td>
<td><strong>Analyze</strong> the various concepts of test generation for combinational, sequential logic circuits and BIST.</td>
<td>PO2 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td><strong>Design</strong> the testable combinational, sequential logic circuits and BIST for the given specifications.</td>
<td>PO3 (L3)</td>
</tr>
<tr>
<td>CO4</td>
<td><strong>Discuss</strong> the verification tools and verification languages.</td>
<td>PO2 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td><strong>Analyze</strong> the role of Stimulus and Response in verification.</td>
<td>PO2 (L2)</td>
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D. Course Articulation Matrix (CAM)

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**Professional Elective-II**

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Contact Period: Lecture: **52 Hrs.** Exam: **3 Hrs.** Weightage : CIE: **50%** SEE: **50%**

**A. Course Learning Objectives (CLOs)**

This course aims to:
1. Discuss optimum receiver performance of a channel with ISI and AWGN.
2. Explain the model of discrete time channel with ISI & the model of discrete time channel by equalizer.
3. Discuss Multichannel and Multicarrier modulation schemes in communication system.
4. To study Spread spectrum signals for digital communication.
5. Discuss multiplexing and modeling of MIMO channels.

**B. Course Content**

**UNIT-I**


Text 1: 9.1, 9.3, 9.4 – (9.4.1 to 9.4.3), 9.5 – (9.5.1 to 9.5.2), 9.6.

Self Learning Component:
1. Design of Band-Limited signals for with and without ISI.
2. Turbo Equalization

**UNIT – II**


Text 1: 10.1 – (10.1.1, 10.1.2, 10.1.3, 10.1.6, 10.1.7), 10.2, 10.4.

Self Learning Component:
1. Blind equalization Based on the Maximum-Likelihood Criterion.

**UNIT – III**


Multicarrier Systems: Signal-Carrier versus Multicarrier Modulation, Capacity of a Non ideal
Linear Filter Channel, Orthogonal Frequency Division Multiplexing (OFDM), Modulation and Demodulation in an OFDM System, Spectrum Characteristics of Multicarrier Signals, Bit and Power Allocation in Multicarrier Modulation, Peak-to-Average Ratio in Multicarrier Modulation.

Text 1: 11.1, 11.2 – (11.2.1 to 11.2.8). 10 Hrs

Self Learning Component:
2. Channel coding considerations in multicarrier modulation.

UNIT – IV


Text 1: 12.1, 12.2 – (12.2.2, 12.2.5), 12.3, 12.4, 12.5 11 Hrs

Self Learning Component:
1. Effect of Pulsed Interference on DS SS Systems.
2. Excision of Narrowband Interference in DS SS Systems

UNIT – V


Text 2: 7.1, 7.2 – (7.2.1 & 7.2.2), 7.3 - (7.3.1 to 7.3.4) 10 Hrs

Self Learning Component:
1. Statistical Modeling in the Angular Domain.
2. Degrees of Freedom and Diversity.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:

REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:

1. NPTEL Course on Fundamentals of MIMO Wireless Communication by Prof. SuvraSekhar Das, IIT Kharagpur Link:- https://nptel.ac.in/courses/117/105/117105132/
2. NPTEL course on Principles of Modern CDMA/ MIMO/ OFDM Wireless Communications by Prof. Aditya K. Jagannatham, IIT Kanpur Link:- https://nptel.ac.in/courses/117/104/117104115/

C. Course Outcomes

<table>
<thead>
<tr>
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<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
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<tbody>
<tr>
<td>CO1</td>
<td>Discuss the concepts of optimum receiver for Band limiting channels with ISI and AWGN.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyse and demonstrate the model of discrete time channel with ISI &amp; the model of discrete time channel by equalizer.</td>
<td>PO2 (L3)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analysis and Understanding of various digital communication systems.</td>
<td>PO1 (L3)</td>
</tr>
<tr>
<td>CO4</td>
<td>Evaluate the performance of various digital communication systems.</td>
<td>PO2 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td>Articulate different modeling schemes for MIMO channels.</td>
<td>PO2 (L3)</td>
</tr>
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</table>

D. Course Articulation Matrix (CAM)

<table>
<thead>
<tr>
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</table>
A. Course Learning Objectives (CLOs)

This course aims to:
1. Discuss the Global e-waste growth in India.
2. Explain the Hazardous substances in waste electrical and electronic equipment-toxicity and release.
3. Understand the importance of e-waste recycling in India.
4. Outline the study of international and national legal framework on e-waste.
5. Describe the Technologies for recovery of resources from electronic waste

B. Course Content

UNIT-I


Text 1: Chapter 1, 2 and 3.

Self Learning Component:
1. Growth of e-waste trade in Delhi and its impact on the environment and health: a case study

UNIT-II


Text 1: Chapter 4 and 5

Self Learning Component:
UNIT- III


Text 1: Chapter 6 and 7 10 Hrs

Self Learning Component:
1. Environmentally Sound e-waste treatment technologies

UNIT –IV


Text 1: Chapter 8, 9 and 10 11 Hrs

Self Learning Component:
1. Procedures for setting-up and management of integrated e-waste facility

UNIT –V


Text 1: Chapter 11, 12 and Chapter 4 in Annexure (4.0 to 4.7). 10 Hrs

Self Learning Component:
1. E-waste recycling/treatment technologies in India

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)
TEXT BOOK:

REFERENCE BOOKS:

C. Course Outcomes

<table>
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<td>CO1</td>
<td>Discuss the Global e-waste growth in India</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Explain the Hazardous substances in waste electrical and electronic equipment-toxicity and release</td>
<td>PO2 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze to understand the importance of e-waste recycling in India</td>
<td>PO2 (L2)</td>
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<tr>
<td>CO4</td>
<td>Outline the study of international and national legal framework on e-waste</td>
<td>PO3 (L5)</td>
</tr>
<tr>
<td>CO5</td>
<td>Describe the Technologies for recovery of resources from electronic waste through case study</td>
<td>PO3 (L4)</td>
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D. Course Articulation Matrix (CAM)

<table>
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Open Elective - I
Course Title: **Principles of Communication Systems**

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### A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the basic knowledge on Electronic Communication Systems.
2. Describe the concept of Amplitude Modulation and Frequency modulation.
4. Explain the concept and importance of Satellite communication.
5. Discuss Fundamentals of Networking and Local Area Network
6. Discuss the importance and applications of Cell phone and wireless technologies

### B. Course Content

**UNIT – I**


**Amplitude Modulation Fundamentals:** AM Concepts, Modulation Index and Percentage of Modulation, Sidebands and the Frequency Domain, AM Power, Single Sideband Modulation, Amplitude Demodulators

**Text 1:** 1.1-1.7, 3.1-3.5, 4.3

**Self Learning Component:**
1. SSB Circuits

**UNIT – II**

**Fundamental of Frequency Modulation:** Basic Principles of Frequency Modulation, Principles of Phase Modulation, Modulation index and side bands, Frequency modulation Versus Amplitude Modulation.

**Digital Communication Techniques:** Digital transmission of data, Parallel and Serial Transmission, Pulse Modulation, Basic Principles of Signal Reproduction, Super heterodyne receivers.

**Text 1:** 5.1-5.3, 5.5, 7.1, 7.2, 7.4, 9.1, 9.2

**Self Learning Component:**
1. Study of Digital communication technologies in TV broadcasting

**UNIT – III**

**Multiplexing and Demultiplexing:** Multiplexing Principles, Frequency division Multiplexing, Time-Division Multiplexing, Pulse-code Modulation, Duplexing

**Fundamentals of Networking and Local Area Networks:** Network Fundamentals, LAN hardware.

**Text 1:** 10.1-10.5, 12.1-12.2

**Self Learning Component:**
1. Advanced Ethernet.
UNIT – IV
Text 1:17.1-17.6, 10 Hrs
Self Learning Component:
1. Make a study of advances made by India in Satellite communication

UNIT – V
Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zigbee and Mesh wireless Networks
Text 1: 20.1-20.5, 21.1 – 21.3 11 Hrs
Self Learning Component:
1. WiMAX and Wireless Metropolitan-Area Networks

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:

REFERENCE BOOKS:
C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Explain the basics of Electronic Communication System.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyse at block level the use of various Digital Communication Techniques and Satellite Communication</td>
<td>PO2 L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>Describe the concept of Networking and Local Area Networks</td>
<td>PO3 (L4)</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain the importance and working of Cell phone, multiplexing and de multiplexing in electronic communication systems</td>
<td>PO1 (L5)</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the use and working of wireless technologies</td>
<td>PO1 (L2)</td>
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D. Course Articulation Matrix (CAM)

<table>
<thead>
<tr>
<th>CO</th>
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Open Elective - I

Course Title: Arduino Controller with Applications

Course Code: P18ECO653   Semester : VI   L-T-P-H : 3-0-0-3   Credits: 3
Contact Period : Lecture : 52 Hrs., Exam: 3 Hrs.   Weightage : CIE: 50%   SEE: 50%

A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the basic knowledge on AVR Controller.
2. Discuss the AVR Architecture and information needed to write program.
3. Able to write the program using C.
4. Provide the basic knowledge on Arduino Controller.
5. Discuss about the applications of Communication Interfaces using Arduino.
6. Discuss the concept of Wireless applications using Arduino.

B. Course Content

UNIT – I

The AVR microcontroller: history and features, microcontrollers and embedded processors, overview of the AVR family.
AVR architecture and assembly language programming: The general purpose registers in the AVR, the AVR data memory using instructions with the data memory, AVR status register, AVR data format and directives introduction to AVR assembly programming, assembling an AVR program the program counter and Program ROM space in the AVR. RISC architecture in the AVR, viewing registers and memory with AVR STUDIO IDE.

Text 1: Chapter 2 and chapter 3  11 Hrs

Self Learning Component:
1. Understand the Branch Instructions and Looping in AVR.
2. Analyze the working principle of STACK in AVR.

UNIT – II

AVR I/O Port Programming: I/O port programming in AVR, I/O bit manipulation programming.
Arithmetic, Logic Instructions and Programs: arithmetic instructions, signed number concepts and arithmetic operations, logic and compare instructions, rotate and shift instructions and data serialization, BCD and ASCII conversion

Text 1:Chapter 4 and Chapter 5  10 Hrs

Self Learning Component:
1. Understand the concept of Call Instructions in AVR.
2. AVR Time Delay and Instruction Pipeline.

UNIT – III

AVR Programming in C: Data types and time delays in C, Programming in C logic operations in C, Data conversion programs in C, Data serialization in C, Memory allocation in C.
LCD and Keyboard Interfacing in C: LCD interfacing , Keyboard interfacing (Excluding Interfacing in Assembly level language)

Text 1: Chapter 7 and Chapter 12  10 Hrs
Self Learning Component:
1. Develop a C program to monitor the status of SW and perform the following operations (Assume switch connected to pin PA7).
   (i) If SW=0; Stepper Motor moves clockwise.
   (ii) If SW=1; Stepper Motor moves counter clockwise.

UNIT – IV
Getting Started and Understanding the Arduino Landscape: Exploring the Arduino Ecosystem, Arduino Functionality, The Microcontroller Programming Interfaces, Input/Output: GPIO, ADCs, and Communication Buses Power Arduino Boards, Creating Your First Program Downloading and Installing the Arduino IDE. Running the IDE and Connecting to the Arduino Breaking Down Your First Program
Communication Interfaces:
The I2C Bus: History of the I2C Bus, I2C Hardware Design, Communication Scheme and ID Numbers, Hardware Requirements and Pull-Up Resistors, Communicating with an I2C, Temperature Probe Setting Up the Hardware, Referencing the Datasheet, Writing the Software. Combining Shift Registers, Serial Communication, and I2C Communications, Building the Hardware for a Temperature Monitoring System Modifying the Embedded Program Writing the Processing Sketch
The SPI Bus and Third-Party Libraries:
Overview of the SPI Bus, SPI Hardware and Communication Design, Hardware Configuration Communication Scheme. Comparing SPI to I2C and UART

Text 2: Chapter 1, Chapter 10 and Chapter 11 10 Hrs

Self Learning Component:
1. Analyze the concept of AVR communication with an SPI Accelerometer.
2. Understand and analyze the Creation of Audiovisual Instrument Using a 3-Axis Accelerometer.

UNIT – V
Going Wireless:
Wi-Fi and the Cloud: The Web, the Arduino, and You, Networking Lingo: The Internet vs. the World Wide Web vs. the Cloud, IP Address, Network Address Translation, MAC Address, HTML, HTTP and HTTPS, GET/POST, DHCP, DNS, Clients and Servers. Your Wi-Fi–Enabled Arduino. Controlling Your Arduino from the Web: Setting Up the I/O Control Hardware, Preparing the Arduino IDE for Use with the Feather Board, Ensuring the Wi-Fi Library is Matched to the Wi-Fi Module’s Firmware, Checking the WINC1500’s Firmware Version, Updating the WINC1500’s Firmware. Writing an Arduino Server Sketch: Connecting to the Network and Retrieving an IP Address via DHCP, Writing the Code for a Bare-Minimum Web Server. Controlling Your Arduino from Inside and Outside Your Local Network: Controlling your Arduino over the Local Network, Using Port Forwarding to Control Your Arduino from Anywhere. Interfacing with Web APIs: Using a Weather API, Creating an Account with the API Service Provider, Understanding How APIs Are Structured, JSON-Formatted Data and Your Arduino, Fetching and Parsing Weather Data, Getting the Local Temperature from the Web on Your Arduino. Completing the Live Temperature Display: Wiring up the LED Readout Display, Driving the Display with Temperature Data.

Text 2: Chapter 17 11 Hrs
Self Learning Component:
1. Understand the Bluetooth Connectivity: Bluetooth Standards and Versions
2. Understand the working principle of:
   - Communication between your Arduino and your Phone.
   - Reading a Sensor over BTLE and adding Support for Third-Party Boards to the Arduino IDE.

Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOKS:

REFERENCE BOOKS:

ONLINE COURSES AND VIDEO LECTURES:
2. https://www.youtube.com/watch?v=UfWqhw1qN_M.
### C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply knowledge of microcontroller and embedded systems to <strong>understand</strong> the concepts of AVR Microcontroller.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Apply the concepts of microcontroller to <strong>analyze</strong> instruction sets and other features in AVR Microcontroller.</td>
<td>PO1 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>To <strong>Analyze</strong> with logical skills to write programs in C for the various interfacing problems for Arduino.</td>
<td>PO2 (L2)</td>
</tr>
<tr>
<td>CO4</td>
<td><strong>Design</strong> and <strong>Develop</strong> the Arduino programming interface for the given hardware and communication specification.</td>
<td>PO3 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td><strong>Design</strong> and <strong>Develop</strong> the Arduino programming interface for wireless communication systems.</td>
<td>PO3 (L3)</td>
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### D. Course Articulation Matrix (CAM)

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</table>
Open Elective- I

Course Title: Biometrics
Course Code: P18ECO654  Semester: VI  L-T-P-H : 3-0-0-3  Credits: 3
Contact Period: Lecture: 52 Hrs, Exam: 3 Hrs.  Weightage: CIE: 50%  SEE: 50%

A. Course Learning Objectives (CLOs)

This course aims to:
1. Provide the basic knowledge on biometrics and its modality.
2. Analyze the handwritten character recognition and its experimental results.
3. Describe the concept of face biometrics.
4. Outline the concept of retina and iris biometrics.
5. Illustrate the concept of vein and fingerprint biometrics.
6. Interpret biometric hand gesture recognition for Indian sign language.
7. Discover the privacy issues and concerns related to biometrics.
8. Discuss biometric cryptography and multimodal biometrics.
9. Explain the importance of watermarking techniques in biometrics.
10. Summarize the scope and future of biometrics and its standards.

B. Course Content

UNIT – I

Introduction: What is Biometrics? History of biometrics, Types of biometric traits, General architecture of biometric system, Basic working of biometric matching (Templates), Biometric system error and performance measures, Design of biometric systems, Applications of biometrics, Benefits of biometrics versus Traditional authentication methods.
Text1: 1.1-1.9 10 Hrs

Text 1:2.1-2.9 11 Hrs

Self Learning Component:
1. Devanagari numeral recognition
2. Isolated handwritten devanagari character recognition using fourier descriptor and hidden.

UNIT – II

Face Biometrics: Introduction, Background of face recognition, Design of face recognition system, Neural network for face recognition, Face detection in video sequences, Challenges in face biometrics, Face recognition methods, Advantages and disadvantages.
Text1: 3.1-3.8

Text 1: 4.1-4.9 10 Hrs
Self Learning Component:
1. Applications of iris biometrics

UNIT – III
Text 1: 5.1 -5.8 and 6.1-6.7 10 Hrs
Self Learning Component:
1. SIFT algorithm

UNIT – IV
Biometric Cryptography and Multimodal Biometrics: Introduction to biometric cryptography, General purpose cryptosystem, Modern cryptography and attacks, Symmetric key ciphers, Cryptographic algorithms, Introduction to multimodal biometrics, Basic architecture of multimodal biometrics, Multimodal biometrics using face and ear, Characteristics and advantages of multimodal biometrics,
Text 1:7.1-7.7and8.1-8.10 10 Hrs
Self Learning Component:
1. AADHAAR: An application of multimodal biometrics.

UNIT – V
Biometrics Scope and Future: Scope and future market of biometrics, Biometric technologies, Applications of biometrics, Biometrics and information technology infrastructure, Role of biometrics in enterprise security, Role of biometrics in border security, Smart card technology and biometrics, Radio frequency identification (RFID) biometrics, DNA biometrics, Comparative study of various biometric techniques.
Text1: 9.1-9.11 and 10.1-10.10 11 Hrs
Self Learning Component:
1. Biometric Standards
Note: No questions from SLC component in the Semester End Exam (SEE), it is evaluated only in Continuous Internal Evaluation (CIE)

TEXT BOOK:

REFERENCE BOOKS:

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Explain the basics of biometric modalities and features of the biometrics.</td>
<td>PO1, (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Apply the various morphological operations for feature extraction in various biometrics</td>
<td>PO2, (L2)</td>
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<tr>
<td>CO3</td>
<td>Analyze the use of various biometrics.</td>
<td>PO3, (L4)</td>
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<tr>
<td>CO4</td>
<td>Understand the role of watermarking techniques in biometrics</td>
<td>PO2, (L2)</td>
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<tr>
<td>CO5</td>
<td>Summarize the privacy issues and concerns related to biometric cryptography</td>
<td>PO3, (L5)</td>
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D. Course Articulation Matrix (CAM)

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Laboratory

Course Title: Circuit Simulation Laboratory
Course Code: P18ECL66  Semester: VI  L-T-P-H : 0-0-3-3  Credits: 1.5
Contact Period : Lab: 36 Hrs.; Exam: 3 Hrs.  Weightage: CIE: 50 %  SEE: 50%

A. Course Learning Objectives (CLOs)

This course aims to:
1. Learning computer aided design and simulation tools
2. Design and verification of circuits at system level.
3. Capturing system requirements and optimize design.

B. Course Content

The design flow must consists of the following

PART –A

Draw the schematic and perform
- Transient analysis,
- AC sweep analysis using Pspice simulator for given specification
  1. Clipper and Clamper Circuit.
  2. MOSFET Amplifier.
  3. CMOS Inverter.
  4. Current Controlled Voltage Source
  5. Voltage Controlled Current Source.
  6. Summing Amplifier
  7. ADC

PART –B

For the following set of experiments the design flow must consists of
- Draw the schematic
- Draw the PCB layout and verify with DRC
- Generate the gerber file for given specification

  1. Inverting amplifier
  2. Design a full adder using basic gates.
  3. Monostable / Astablemultivibrator
  4. Power supply design with regulators
  5. Amplitude modulator
  6. Frequency modulator
  7. Counter design with display.

Open Ended Experiment

  1. Temperature monitoring based on environmental condition.
  2. Implement home automation with the help of relays
C. Course Outcomes

<table>
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<tr>
<th>CO #</th>
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<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply the knowledge of the digital system to design the schematic in Pspice Orcad tools.</td>
<td>PO1, PO5 (L1)</td>
</tr>
<tr>
<td>CO2</td>
<td>Interpret the concept of transient and ac sweep analysis using Pspice Simulator</td>
<td>PO2, PO4 (L4)</td>
</tr>
<tr>
<td>CO3</td>
<td>Design PCB for the basic analog and digital circuit using Orcad tool</td>
<td>PO3, PO5 (L5)</td>
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<tr>
<td>CO4</td>
<td>Analyze and Optimize the circuit for given specification</td>
<td>PO2, PO3, PO4, PO5 (L4) , (L3)</td>
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D. Course Articulation Matrix (CAM)

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Laboratory

Course Title: Analog and Digital VLSI Design Laboratory

<table>
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<th>Semester: VI</th>
<th>L-T-P-H: 0-0-3-3</th>
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<td>Contact Period: Lab: 36 Hrs.; Exam: 3 Hrs.</td>
<td>Weightage: CIE: 50%</td>
<td>SEE 50%</td>
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</table>

A. Course Learning Objectives (CLOs)

This course aims to:
1. Explore the CAD tool and understand the flow of the Full Custom IC design cycle.
2. Learn DRC, LVS and Parasitic Extraction of the various designs.
3. Design and simulate the various basic CMOS analog circuits and use them in higher circuits like operational amplifiers using design abstraction concepts.
4. Design and simulate the various basic CMOS digital circuits and use them in higher circuits like adders and shift registers using design abstraction concepts.
5. Understand simulation and synthesis of digital design.
6. Analyze the ASIC Design flow.
7. RTL Design, simulate and verify digital circuits.

B. Course Content

Part A: Analog VLSI Design

Analog Design Flow:
The design flow must consist of the following:
1. Draw the schematic and verify the following:
   - DC Analysis
   - Transient Analysis
2. Draw the Layout and verify the DRC, ERC, and LVS.
3. Check for LVS.
4. Extract RC and Back annotate the same and verify the Design
5. Design an Inverter gate with given specification.
6. Design an NAND and NOR gate with given specification.
7. Design the following circuits, in different styles, for the given specification
   - Common source amplifier
   - Common Drain amplifier.
10. Analysis, Design and Characterization of SRAM memory cell/block.
Part B. Digital VLSI Design

ASIC-Digital Design / FPGA Digital Design

1. Develop Verilog Code for the n inverter, Buffer and their Test Bench for verification.
3. Design and Develop Verilog code for 4/8-bit Carry Ripple Adder.

Open Ended Experiment

1. Design and simulate Gilbert cell for Analog multiplication

OR

2. Demonstration of place and Route steps with DMA MAC example using INNOVUS.

C. Course Outcomes

<table>
<thead>
<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Apply the knowledge of the digital system to design of the schematic and layout in cadence tools.</td>
<td>PO1 (L1)</td>
</tr>
<tr>
<td>CO2</td>
<td>Interpret the outcome of DC Analysis, AC Analysis and Transient Analysis in analog circuits.</td>
<td>PO4, PO9 (L4)</td>
</tr>
<tr>
<td>CO3</td>
<td>Design and simulate basic CMOS circuits like inverter, common source amplifier and differential amplifiers.</td>
<td>PO3, PO5, PO8 (L5)</td>
</tr>
<tr>
<td>CO4</td>
<td>Analysis of the design for power, timing and area.</td>
<td>PO2, PO5 (L4)</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop 4/8-bit Carry Ripple Adder, Carry Look Ahead adder and Booth Multiplication using Verilog code.</td>
<td>PO3, PO5, PO7 (L5)</td>
</tr>
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</table>

D. Course Articulation Matrix (CAM)

<table>
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<tr>
<th>CO</th>
<th>PO 1</th>
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<th>PO 11</th>
<th>PO 12</th>
<th>PS O1</th>
<th>PS O2</th>
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P18 Scheme, III Year (V & VI Semester) Syllabus
Skill Laboratory - Core

<table>
<thead>
<tr>
<th>Course Title: Skill Oriented Laboratory – II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Code: P18ECL68</td>
</tr>
<tr>
<td>Contact Period: Lab: 26 Hrs., Exam: 2 Hrs.</td>
</tr>
</tbody>
</table>

Track-1: Embedded Systems and IOT Laboratory

A. Course Learning Objectives (CLO’S)

This course aims to:
1. Understand how to apply standard IOT architectures for your IOT project.
2. Understand different basic programming for IOT applications.
3. Understand the interface of different sensors and signaling peripherals to arduino & raspberry pi.
4. Perform basic real-time experiments.
5. Analyze the overall operation of IOT application.

B. Course Content

1) Introduction to IOT Signaling Peripherals:
   a) Perform an experiment to check the LED patterns and control Analog I/O- LED fading.

2) Motor Speed and Digital Clock:
   a) Perform an experiment to control the speed of a Motor.
   b) Perform an experiment to implement a Simple Digital Clock.

3) Perform an experiment to verify Wireless connectivity.

4) LED Controlling:
   a) Perform an experiment check Inter/ Intranet Controlled LEDs.
   b) Perform an experiment check Internet-based Multicolor-LED control.

5) Design an experiment to demonstrate Internet-based Home Automation.
6) Demonstrate the effectiveness of Internet-based Home Security System.
7) Perform an experiment to interface Temperature Sensor& IOT.
8) Perform an experiment to implement Switch-based Counter.
9) Design an Internet-based Street Light Control.
10) Design a water level control unit using the Internet.
11) Perform an experiment for real-time Moisture Sensing and logging the data.

REFERENCE BOOKS:
Track-2: SystemVerilog Laboratory

A. Course Learning Objectives (CLO’S)

This course aims to:

1. Understand the basics of programming in SystemVerilog.
2. Learn SystemVerilog Constraint Random Verification to verify VLSI designs, usage of SystemVerilog communication features like Semaphores, events and mail boxes.
3. Understand and use the SystemVerilog RTL design and synthesis features.
4. Understand the methods of robust verification.
5. Develop a stimulus generator to create constrained random test stimulus.

C. Course Content

1. Using the assertions construct of SystemVerilog develop a code to validate the behaviour of a given design.
2. Develop a SystemVerilog code to create a mail box and use it for exchanging data between two threads.
3. Develop a SystemVerilog code to simulate and verify the operation of a serial adder.
4. Develop a SystemVerilog code to simulate, verify and synthesize the function of a RAM for given specifications.
5. Design and develop a SystemVerilog code to simulate and synthesize a state machine for the specific requirements also develop test cases to verify its functionality.
6. Design and develop a SystemVerilog test bench to verify the operation of a given functional block with respect to its specifications.
7. Using class data types in SystemVerilog develop a code for control register with given specifications and simulate its operation.
8. Using SystemVerilog data types and facilities develop a code to verify the operation of binary search tree logic block.
9. Develop a SystemVerilog code to check the consistency of data flow between the modules of a given functional block.
10. Using SystemVerilog Class data type, constraints and randomization facilities develop a code for SRAM functionality and verify its operation through simulation.
11. Using SystemVerilog Threads and mail box facility develop a code to verify the operation of a given logical functionality.

REFERENCE BOOKS:

Track-3: Java and Web Technologies Laboratory

A. Course Learning Objectives (CLO’S)

This course aims to:
1. To understand object oriented concepts in Java
2. To execute basic SQL queries
3. To develop an ability to design and implement websites with client side scripts, and server side scripting.

B. Course Content

1) Programs on HTML5:
   a) Write a java program to develop a website page to handle simple billing system on HTML5.

2) CSS (Cascading Style Sheets):
   a) Write a program to develop a website page on CSS.

3) Executing basic SQL queries: Insert, Delete, Search, Update:
   a) Design a database using MySQL to insert and delete entries of an application based management system.

4) Executing basic SQL queries: Search:
   a) Design a database using MySQL to search for specify entries in an application based data management system.

5) Executing basic SQL queries: Update:
   a) Design a database using MySQL to update/over write entries in an application based management system.

6) Programs on Java Script.
   a) Writing Java Scripts for different applications and other interfaces.

7) PHP programs:
   a) PHP program writing.

REFERENCE BOOKS:
### C. Course Outcomes

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<tr>
<th>CO #</th>
<th>Course Outcome</th>
<th>Program Outcome Addressed (PO #) with BTL</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Ability to <strong>understand and verify</strong> basic concepts of embedded theory, Java programming and SystemVerilog programming with experimentation</td>
<td>PO1(L1), PO2 (L2)</td>
</tr>
<tr>
<td>CO2</td>
<td>Ability to <strong>analyse and discriminate</strong> intricacies of embedded theory, Java programming and SystemVerilog programming</td>
<td>PO1(L2), PO2(L4), PO3 (L2)</td>
</tr>
<tr>
<td>CO3</td>
<td>Ability to <strong>use modern tools</strong> and get tuned to industrial requirements</td>
<td>PO5 (L3)</td>
</tr>
<tr>
<td>CO4</td>
<td>Will be able to <strong>develop</strong> small projects through knowledge gained out of practical session</td>
<td>PO2(L4), PO3 (L3)</td>
</tr>
<tr>
<td>CO5</td>
<td>Will learn <strong>professional ethics</strong>, project management capabilities and working in a team</td>
<td>PO8(L2), PO9 (L3)</td>
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</tbody>
</table>

### D. Course Articulation Matrix (CAM)

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</table>
Course Title: Technical Skills – II (Internals of C Programming)

Course Code: P18HU692 | Semester: VI | L-T-P-H : 2-0-0-2 | Credits: 1
Contact Period : Lecture: 26 Hrs. Exam: 2 Hrs. | Weightage: CIE: 50% SEE: 50%

A. Course Learning Objectives (CLO’S)

This course aims to:
1. Strengthen their understanding of Introduction to Computer Science, C, and Data Structures
2. Write effective codes on C Programming

Overall Syllabus Breakup:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Module name</th>
<th>Classroom (Hours)</th>
<th>Lab (Hours)</th>
<th>Total duration (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Computer Science</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>2.</td>
<td>C Programming</td>
<td>0</td>
<td>14</td>
<td>14</td>
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<tr>
<td>3.</td>
<td>Introduction to Data Structures</td>
<td>4</td>
<td>6</td>
<td>10</td>
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<td></td>
<td><strong>Total Hours</strong></td>
<td><strong>6</strong></td>
<td><strong>20</strong></td>
<td><strong>26</strong></td>
</tr>
</tbody>
</table>

Learning Outcomes:
After undergoing training in this course, the students will be in a position to
1. Write complete program based on the requirements and to debug.
2. Frame effective programs using C programming and Data Structures.

Assessments:
Each of the modules (C and Data Structures) will have two types of assessments –
1. Multiple-choice assessment for programming logic, concepts and debugging
2. Coding
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Topics covered</th>
<th>Learning outcome</th>
<th>Type of learning</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction to Computer Science:</td>
<td>Understand the basics of computer structure and operation of computers and their peripherals and need of Operating System.</td>
<td>Class - 2</td>
<td>2</td>
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<tr>
<td></td>
<td>• Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.</td>
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<td></td>
<td>• Operating System - An Introduction: Definition and functions of operating systems. discussion on evolution of operating systems and different structures of operating systems.</td>
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<tr>
<td>2.</td>
<td>C Programming Language: Medium to difficult level of Snippets for</td>
<td>Understand the concepts of snippets in a programming term for a small region of re-usable source code, machine code, or text. In C it could be part of the program - A Function, typedef or a part of the algorithm or code. Understand the concepts of programs as sequences or machine instructions.</td>
<td>Lab - 14</td>
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<td></td>
<td>• Understanding basic syntax</td>
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<td>• If - else statement</td>
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<td>• Switch case</td>
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<td>• Struct</td>
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<td>• For loop</td>
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<td>• While and do - while loop</td>
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<td>• Array</td>
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<td>• Preprocessing</td>
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<tr>
<td>3.</td>
<td>Introduction to Data Structures: Data Structures Basics: Structure and Problem Solving, Data structures, Data structure Operations, Algorithm: complexity, Time-space tradeoff.</td>
<td>Understand common data structures and the algorithms that build and manipulate them including various sorting and searching algorithms. Data structures include arrays, linked lists, stacks, queues, Features, properties, applications, enumerators, and performance issues.</td>
<td>Class – 4 Lab - 6</td>
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<tr>
<td></td>
<td>• Linked List</td>
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<td>• Stack and Queue</td>
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<tr>
<td></td>
<td>• Searching and Sorting Techniques</td>
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