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|-------------------------------------------------------------------|
| Curriculum Structure and Curriculum Content for the Batch 2023-27 |
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|---------------------------------------------------------------|
| School /Department: Electronics and Communication Engineering |
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|                                  |
|----------------------------------|
| Program: Bachelor Of Engineering |
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## Vision and Mission of KLE Technological University

### Vision

KLE Technological University will be a national leader in Higher Education—recognised globally for innovative culture, outstanding student experience, research excellence and social impact.

### Mission

KLE Technological University is dedicated to teaching that meets highest standards of excellence, generation and application of new knowledge through research and creative endeavors.

The three-fold mission of the University is:

- To offer undergraduate and post-graduate programs with engaged and experiential learning environment enriched by high quality instruction that prepares students to succeed in their lives and professional careers.
- To enable and grow disciplinary and inter-disciplinary areas of research that build on present strengths and future opportunities aligning with areas of national strategic importance and priority.
- To actively engage in the Socio-economic development of the region by contributing our expertise, experience and leadership, to enhance competitiveness and quality of life.

As a unified community of faculty, staff and students, we work together with the spirit of collaboration and partnership to accomplish our mission.

## **Vision and Mission Statements of the School / Department**

### **Vision**

KLE Tech-School of Electronics and Communication will be well recognized nationally and internationally for excellence in its educational programs, pioneering research and impact on the industry and society.

### **Mission**

1. To create a unique learning environment through rigorous curriculum of theory and practice that develops students' technical, scientific, and professional skills and qualities to succeed in wide range of electronics and computing businesses and occupations.
2. To nurture spirit of innovation and state-of-the-art research to advance the boundaries of disciplinary and interdisciplinary knowledge and its applications.
3. To collaborate within and beyond the discipline to create solutions that benefit humanity and society

## Program Educational Objectives/Program Outcomes and Program-Specific Objectives

| <b>Program Educational Objectives -PEO's</b>                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Graduates will demonstrate peer- recognized technical competency to solve contemporary problems in the analysis, design and development of electronic devices and systems.                                                                                                                                       |
| 2. Graduates will demonstrate leadership and initiative to advance professional and organizational goals with commitment to ethical standards of profession, teamwork and respect for diverse cultural background.                                                                                                  |
| 3. Graduates will be engaged in ongoing learning and professional development through pursuing higher education, and self-study.                                                                                                                                                                                    |
| 4. Graduates will be committed to creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.                                                                                                                                     |
| <b>Program Outcomes-PO's</b>                                                                                                                                                                                                                                                                                        |
| PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.                                                              |
| PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)                                                                                                     |
| PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. WK 5 |
| PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. WK 8                                                             |

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

WK 2 and WK 6

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

(WK 1, WK 5 and WK 7)

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

WK 9

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

- i) Independent and life-long learning
- ii) Adaptability to new and emerging technologies and
- iii) Critical thinking in the broadest context of technological change.

(WK 8)

#### *Program Specific Objectives -PSO's*

PSO 1: 12

An ability to apply design principles in the development of hardware and software systems of varying complexity.



PSO 2:13

Demonstrate the knowledge of the state of art tools and apply for the development of VLSI circuits/systems.

PSO 3:14

An ability to use appropriate modern techniques for analysis, design and development of Communication components/systems

## Curriculum Structure-Overall

| Course with course code | I                                                               | II                                                           | III                                                                   | IV                                                                          | V                                                                        | VI                                                                      | VII                                                  | VIII                                                    |
|-------------------------|-----------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------|
|                         | Single Variable Calculus<br>4-1-0<br>(18EMAB101)                | Multivariable Calculus<br>(4-1-0)<br>(18EMAB102)             | BS: Integral Transforms and Statistics<br>(15EMAB203)<br><u>4-0-0</u> | BS: Linear Algebra & Partial Differential Equations<br>(15EMAB208)<br>4-0-0 | PC10: CMOS VLSI Circuits<br>4-0-0<br>(24EECC301)                         | H3: Professional Aptitude and Logical reasoning<br>3-0-0<br>(16EHSC301) | Wireless and Mobile Networks<br>2-0-1<br>(25EECC403) | PSE Elective 6<br>3-0-0<br>(25EECEXXX)/                 |
|                         | Engineering Physics<br>(22EPHB101)<br>3-0-0                     | Engineering Chemistry<br>3-0-0<br>(22ECHB102)                | ES1: Corporate Communication<br>(24EHS201)<br><u>0-0-0</u>            | ES2: Problem Solving & Analysis<br>(24EHS202)<br><u>0-0-0</u>               | PC11: Communication System<br>3-0-0<br>(25EECC302)                       | ES4: Industry Readiness & Leadership Skills<br>0-0-0<br>(23EHS304)      | PSE Elective 2<br>3-0-0<br>(25EECEXXX)               | Open Elective 1<br>3-0-0<br>(18EECOXXX)/                |
|                         | Engineering Mechanics<br>(4-0-0)<br>(15ECVF101)                 | Problem Solving with Data Structures<br>0-0-3<br>(18ECSP102) | PC1: Circuit Analysis<br>(22EECC201)<br><u>4-0-0</u>                  | ES4: Electromagnetic Fields and Waves<br>(23EECC209)<br><u>3-0-0</u>        | PC12: Digital Signal Processing<br>2-0-2<br>(25EECC303)                  | PC13: Automotive Electronics<br>3-0-1<br>(24EECC305)                    | PSE Elective 3<br>3-0-0<br>(25EECEXXX)               | Internship-Training<br>0-0-6<br>(18EECI493)             |
|                         | C Programming for Problem solving<br>(0-0-3)<br>(18ECSP101)     | Engineering Exploration<br>0-0-3<br>(22ECRP101)              | PC2: Analog Electronic Circuits<br>(22EECC202)<br><u>4-0-0</u>        | PC5: Linear Integrated Circuits<br>(24EECC203)<br><u>4-0-0</u>              | PC13: Operating System & Embedded Systems Design<br>3-0-1<br>(24EECC304) | PC14: Computer Communication Networks I<br>4-0-0<br>(23EECC306)         | PSE Elective 4<br>3-0-0<br>(25EECEXXX)               | <u>Internship Project</u><br><u>0-0-11</u><br>20EECW494 |
|                         | Basic Electrical Engineering<br>(3-0-0)<br>(18EEEF101)          | Basic Electronics<br>(18EECF101)<br><u>4-0-0</u>             | PC3: Digital Circuits<br>(19EECC201)<br>4-0-0                         | PC6: Control Systems<br>(23EECC206)<br><u>4-0-0</u>                         | PCLx: CMOS VLSI Circuits Lab<br>0-0-1<br>(24EECP301)                     | GEN AI<br>2-0-1<br>(24EECC308)                                          | PSE Elective 5<br>3-0-0<br>(25EECEXXX)               | Capstone Project<br>0-0-11<br>(20EECW402)               |
|                         | Design thinking for Social Innovation<br>(0-1-1)<br>(20EHSP101) | Basic Mechanical Engineering<br>(22EMEF101)<br><u>3-0-0</u>  | PC4: Signals & Systems<br>4-0-0<br>(19EECC202)                        | PC7: ARM Processor & Applications<br>(22EECC207)<br>3-0-0                   | PC15: Machine Learning & Deep Learning<br>2-0-2<br>(24EECC309)           | PSE Elective 1<br>(17EECEXXX)<br><u>3-0-0</u>                           | P3: Senior Design Project<br>0-0-6<br>(20EECW401)    |                                                         |
|                         | Applied Physics Lab<br>(0-0-1)<br>(21EPHP101)                   | Professional Communication<br>1-1-0<br>(15EHS101)            | PCL1: Digital Circuits Lab<br>0-0-1<br>(22EECP201)                    | PC8: Digital System Design using Verilog<br>(22EECC208)                     | P1: Mini Project<br>(23EECW301)<br><u>0-0-3</u>                          | PCL7: Computer Communication Networks I Lab<br>0-0-1                    | CIPE<br>2-0-0<br>(15EHSC402)                         |                                                         |

|                |           |           |                                                                                                              |                                                                                                               |                                                                     |                                            |           |           |
|----------------|-----------|-----------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------|-----------|-----------|
|                |           |           |                                                                                                              | <u>2-0-0</u>                                                                                                  |                                                                     | (23EECP303)                                |           |           |
|                |           |           | PCL2: Analog Electronic Circuits Lab (22EECP202) <u>0-0-1</u>                                                | PCL3: Data acquisition and controls Lab (22EECP203) <u>0-0-1</u>                                              | ES3: Arithmetical Thinking & Analytical Reasoning 0-0-0 (23EHSA303) | P2: Minor Project (24EECW302) <u>0-0-3</u> |           |           |
|                |           |           | ES2: Microcontroller Architecture & Programming (22EECF202) 3-0-0<br><br>C Programming (Diploma) (22EECF202) | PCL4: ARM Microcontroller Lab (22EECP204) <u>0-0-1</u>                                                        | Communication Systems Lab 0-0-1 (25EECP304)                         |                                            |           |           |
|                |           |           |                                                                                                              | PCL3: Data Structure Applications Lab (21EECF201) 2-0-0<br><br>PCL3: Data Structure Lab (Diploma) (21EECF203) |                                                                     |                                            |           |           |
| <b>Credits</b> | <b>21</b> | <b>23</b> | <b>22</b>                                                                                                    | <b>22</b>                                                                                                     | <b>24</b>                                                           | <b>24</b>                                  | <b>23</b> | <b>17</b> |

**Total Credits: 176**

## Curriculum Structure-Semester wise

### Semester - I

| No           | Code      | Course                                                | Category | L-T-P | Credits   | Contact Hours | ISA        | ESA        | Total      | Exam Duration (in hrs) |
|--------------|-----------|-------------------------------------------------------|----------|-------|-----------|---------------|------------|------------|------------|------------------------|
| 1            | 18EMAB101 | <a href="#">Single Variable Calculus</a>              | BS       | 4-1-0 | 5         | 6             | 50         | 50         | 100        | 3 Hrs.                 |
| 2            | 22EPHB101 | <a href="#">Engineering Physics</a>                   | BS       | 3-0-0 | 3         | 3             | 50         | 50         | 100        | 3 Hrs.                 |
| 3            | 15ECVF101 | <a href="#">Engineering Mechanics</a>                 | ES       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 Hrs.                 |
| 4            | 18ECSP101 | <a href="#">C Programming for Problem solving</a>     | ES       | 0-0-3 | 3         | 6             | 80         | 20         | 100        | 3 Hrs.                 |
| 5            | 18EEEF101 | <a href="#">Basic Electrical Engineering</a>          | ES       | 3-0-0 | 3         | 3             | 50         | 50         | 100        | 3 Hrs.                 |
| 6            | 20EHSP101 | <a href="#">Design Thinking for Social Innovation</a> | HSS      | 0-1-1 | 2         | 4             | 80         | 20         | 100        | 2 Hrs.                 |
| 7            | 21EPHP101 | <a href="#">Applied Physics Lab</a>                   | BS       | 0-0-1 | 1         | 2             | 80         | 20         | 100        | 3 Hrs.                 |
| <b>TOTAL</b> |           |                                                       |          |       | <b>21</b> | <b>28</b>     | <b>440</b> | <b>260</b> | <b>700</b> |                        |

## Semester - II

| No | Code      | Course                                               | Category | L-T-P | Credits   | Contact Hours | ISA        | ESA        | Total      | Exam Duration (in hrs) |
|----|-----------|------------------------------------------------------|----------|-------|-----------|---------------|------------|------------|------------|------------------------|
| 1  | 18EMAB102 | <a href="#">Multivariable Calculus</a>               | BS       | 4-1-0 | 5         | 6             | 50         | 50         | 100        | 3 Hrs.                 |
| 2  | 22ECHB102 | <a href="#">Engineering Chemistry</a>                | BS       | 3-0-0 | 3         | 3             | 50         | 50         | 100        | 3 Hrs.                 |
| 3  | 18ECSP102 | <a href="#">Problem Solving with Data Structures</a> | ES       | 0-0-3 | 3         | 6             | 80         | 20         | 100        | 3 Hrs.                 |
| 4  | 15EHS101  | <a href="#">Professional Communication</a>           | HSS      | 1-1-0 | 2         | 3             | 50         | 50         | 100        | 3 Hrs.                 |
| 5  | 22ECRP101 | <a href="#">Engineering Exploration</a>              | ES       | 0-0-3 | 3         | 6             | 80         | 20         | 100        | 2 Hrs.                 |
| 6  | 18EECF101 | <a href="#">Basic Electronics</a>                    | ES       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 Hrs.                 |
| 7  | 22EMEF101 | <a href="#">Basic Mechanical Engineering</a>         | ES       | 2-1-0 | 3         | 4             | 50         | 50         | 100        | 3 Hrs.                 |
|    |           | <b>TOTAL</b>                                         |          |       | <b>23</b> | <b>32</b>     | <b>410</b> | <b>290</b> | <b>700</b> |                        |

### Semester- III

| No           | Code      | Course                                                              | Category | L-T-P | Credits   | Contact Hours | ISA        | ESA        | Total      | Exam Duration (in hrs) |
|--------------|-----------|---------------------------------------------------------------------|----------|-------|-----------|---------------|------------|------------|------------|------------------------|
| 1            | 15EMAB203 | <a href="#">BS: Integral Transforms and Statistics</a>              | BS       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 hours                |
| 2            | 24EHSA201 | ES1: <a href="#">Corporate Communication</a>                        | ES       | 0-0-0 | 0         | 0             | 100        | --         | 100        | 3 hours                |
| 3            | 22EECC201 | <a href="#">PC1: Circuit Analysis</a>                               | PC       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 hours                |
| 4            | 22EECC202 | <a href="#">PC2: Analog Electronic Circuits</a>                     | PC       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 hours                |
| 5            | 19EECC201 | <a href="#">PC3: Digital Circuits</a>                               | PC       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 hours                |
| 6            | 19EECC202 | PC4: <a href="#">Signals &amp; Systems</a>                          | ES       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 2 hours                |
| 7            | 22EECP201 | PCL1: <a href="#">Digital Circuits Lab</a>                          | PC       | 0-0-1 | 1         | 2             | 80         | 20         | 100        | 2 hours                |
| 8            | 22EECP202 | <a href="#">PCL2: Analog Electronic Circuits Lab</a>                | PC       | 0-0-1 | 1         | 2             | 80         | 20         | 100        | 2 hours                |
| 9            | 22EECF202 | <a href="#">ES2: Microcontroller Architecture &amp; Programming</a> | ES       | 2-0-1 | 2-0-1     | 4             | 80         | 20         | 100        | 2 hours                |
|              | 24EECF204 | <a href="#">C Programming for Problem solving (Dip)</a>             |          | 0-0-2 | 0-0-2     | 4             |            |            |            |                        |
| <b>TOTAL</b> |           |                                                                     |          |       | <b>22</b> |               | <b>590</b> | <b>310</b> | <b>900</b> |                        |

### Semester- IV

| No        | Code      | Course                                                                  | Category | L-T-P | Credits   | Contact Hours | ISA | ESA | Total | Exam Duration (in hrs) |
|-----------|-----------|-------------------------------------------------------------------------|----------|-------|-----------|---------------|-----|-----|-------|------------------------|
| 1         | 15EMAB208 | <a href="#">BS: Linear Algebra &amp; Partial Differential Equations</a> | BS       | 4-0-0 | 4         | 4             | 50  | 50  | 100   | 3 hours                |
| 2         | 24EHSA202 | <a href="#">ES2: Problem Solving &amp; Analysis</a>                     | ES       | 0-0-0 | 0         | 0             | 100 | --  | 100   | 3 hours                |
| 3         | 23EECC209 | <a href="#">ES4: Electromagnetic Fields and Waves</a>                   | PC       | 3-0-0 | 3         | 3             | 50  | 50  | 100   | 3 hours                |
| 4         | 24EECC203 | <a href="#">PC5: Linear Integrated Circuits</a>                         | PC       | 4-0-0 | 4         | 4             | 50  | 50  | 100   | 3 hours                |
| 5         | 23EECC206 | <a href="#">PC6: Control Systems</a>                                    | PC       | 4-0-0 | 4         | 4             | 50  | 50  | 100   | 3 hours                |
| 6         | 22EECC207 | <a href="#">PC7: ARM Processor &amp; Applications</a>                   | PC       | 3-0-0 | 3         | 3             | 50  | 50  | 100   | 3 hours                |
| 7         | 22EECC208 | <a href="#">PC8: Digital System Design using Verilog</a>                | PC       | 0-0-2 | 2         | 4             | 80  | 20  | 100   | 2 hours                |
| 8         | 22EECP203 | <a href="#">PCL3: Data acquisition and controls Lab</a>                 | PC       | 0-0-1 | 1         | 2             | 80  | 20  | 100   | 2 hours                |
| 9         | 22EECP204 | <a href="#">PCL4: ARM Microcontroller Lab</a>                           | PC       | 0-0-1 | 1         | 2             | 80  | 20  | 100   | 2 hours                |
| <b>10</b> | 21EECF201 | <a href="#">PCL3: Data Structure Applications Lab</a>                   | ES       | 0-0-2 | 2         | 4             | 80  | 20  | 100   | 2 hours                |
|           | 24EECF206 | <a href="#">PCL3: Problem Solving with Data Structures (Diploma)</a>    |          | 0-0-3 | 3         | 6             | 80  | 20  | 100   |                        |
|           |           |                                                                         |          |       | <b>22</b> | <b>26</b>     | 670 | 330 | 1000  |                        |

### Semester- V

| No    | Code      | Course                                                               | Category | L-T-P | Credits   | Contact Hours | ISA        | ESA        | Total      | Exam Duration (in hrs) |
|-------|-----------|----------------------------------------------------------------------|----------|-------|-----------|---------------|------------|------------|------------|------------------------|
| 1     | 24EECC301 | <a href="#">PC10: CMOS VLSI Circuits</a>                             | PC       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 hours                |
| 2     | 25EECC302 | <a href="#">PC11: Communication System</a>                           | PC       | 3-0-0 | 3         | 3             | 50         | 50         | 100        | 3 hours                |
| 3     | 25EECC303 | <a href="#">PC12: Digital Signal Processing</a>                      | PC       | 2-0-2 | 4         | 6             | 50         | 50         | 100        | 3 hours                |
| 4     | 25EECC304 | <a href="#">PC13: Operating System &amp; Embedded Systems Design</a> | PC       | 3-0-1 | 4         | 5             | 63         | 37         | 100        | 3 hours                |
| 5     | 24EECP301 | <a href="#">PCLx: CMOS VLSI Circuits Lab</a>                         | PC       | 0-0-1 | 1         | 2             | 80         | 20         | 100        | 2 hours                |
| 6     | 24EECC309 | <a href="#">PC15: Machine Learning &amp; Deep Learning</a>           | PC       | 2-0-2 | 4         | 6             | 50         | 50         | 100        | 3 hours                |
| 7     | 23EECW301 | <a href="#">P1: Mini Project</a>                                     | PW       | 0-0-3 | 3         | 6             | 50         | 50         | 100        | 2 hours                |
| 8     | 23EHSA303 | <a href="#">ES3:Arithmetical Thinking &amp; Analytical Reasoning</a> | Audit    | 0-0-0 | 0         | 0             | 50         | 50         | 100        | 3 hours                |
| 9     | 25EECP304 | <a href="#">Communication Systems Lab</a>                            | PC       | 0-0-1 | 1         | 2             | 80         | 20         | 100        | 2 hours                |
| TOTAL |           |                                                                      |          |       | <b>24</b> | <b>34</b>     | <b>523</b> | <b>377</b> | <b>900</b> |                        |

### Semester- VI

| No | Code      | Course                                                           | Category | L-T-P | Credits   | Contact Hours | ISA        | ESA        | Total      | Exam Duration (in hrs) |
|----|-----------|------------------------------------------------------------------|----------|-------|-----------|---------------|------------|------------|------------|------------------------|
| 1  | 16EHSC301 | <a href="#">H3: Professional Aptitude and Logical reasoning.</a> | HC       | 3-0-0 | 3         | 3             | 50         | 50         | 100        | 3 hours                |
| 2  | 23EHSA304 | <a href="#">ES4: Industry Readiness &amp; Leadership Skills</a>  | ES       | 0-0-0 | 0         | 0             | 25         | 75         | 100        | 3 hours                |
| 3  | 24EECC305 | <a href="#">PC13: Automotive Electronics</a>                     | PC       | 3-0-1 | 4         | 5             | 63         | 37         | 100        | 3 hours                |
| 4  | 23EECC306 | <a href="#">PC14: Computer Communication Networks I</a>          | PC       | 4-0-0 | 4         | 4             | 50         | 50         | 100        | 3 hours                |
| 5  | 24EECC308 | <a href="#">GEN AI</a>                                           | PC       | 2-0-1 | 3         | 4             | 67         | 33         | 100        | 3 hours                |
| 6  | 17EECEXXX | PSE Elective 1                                                   | PE       | 3-0-0 | 3         | 3             | 50         | 50         | 100        | 3 hours                |
| 7  | 23EECP303 | <a href="#">PCL7: Computer Communication Networks I Lab</a>      | PC       | 0-0-1 | 1         | 2             | 80         | 20         | 100        | 2 hours                |
| 8  | 24EECW302 | <a href="#">P2: Minor Project - I</a>                            | PW       | 0-0-6 | 6         | 12            | 50         | 50         | 100        | 2 hours                |
|    |           | <b>TOTAL</b>                                                     |          |       | <b>24</b> | <b>33</b>     | <b>435</b> | <b>365</b> | <b>800</b> |                        |

### Semester- VII

| No    | Code      | Course                                       | Category | L-T-P | Credits | Contact Hours | ISA | ESA | Total | Exam Duration (in hrs) |
|-------|-----------|----------------------------------------------|----------|-------|---------|---------------|-----|-----|-------|------------------------|
| 1     | 25EECC403 | <a href="#">Wireless and Mobile Networks</a> | PSC      | 2-0-1 | 3       | 4             | 67  | 33  | 100   | 2 hours                |
| 2     | 25EECEXXX | PSE Elective 2                               | PSE      | 3-0-0 | 3       | 3             | 50  | 50  | 100   | 3 hours                |
| 3     | 25EECEXXX | PSE Elective 3                               | PSE      | 3-0-0 | 3       | 3             | 50  | 50  | 100   | 3 hours                |
| 4     | 25EECEXXX | PSE Elective 4                               | PSE      | 3-0-0 | 3       | 3             | 50  | 50  | 100   | 3 hours                |
| 5     | 25EECEXXX | PSE Elective 5                               | PSE      | 3-0-0 | 3       | 3             | 50  | 50  | 100   | 3 hours                |
| 6     | 20EECW401 | P3: <a href="#">Senior Design Project</a>    | PW       | 0-0-6 | 6       | 12            | 50  | 50  | 100   | 3 hours                |
| 7     | 15EHSC402 | <a href="#">CIPE&amp; EVS</a>                | M        | 2-0-0 | 2       | 2             | 50  | 50  | 100   | 3 hours                |
| TOTAL |           |                                              |          |       | 23      | 30            | 367 | 334 | 700   |                        |

### Semester- VIII

| No    | Code      | Course                               | Category | L-T-P  | Credits | Contact Hours | ISA | ESA | Total | Exam Duration (in hrs) |
|-------|-----------|--------------------------------------|----------|--------|---------|---------------|-----|-----|-------|------------------------|
| 1     | 18EECEXXX | PSE Elective 6                       | PSE      | 3-0-0  | 3       | 3             | 50  | 50  | 100   | 3 hours                |
| 2     | 18EECOXXX | Open Elective 1                      | OE       | 3-0-0  | 3       | 3             | 50  | 50  | 100   | 3 hours                |
|       |           |                                      |          |        |         |               |     |     |       |                        |
| 3     | 18EECI493 | <a href="#">Internship- Training</a> | PRJ      | 0-0-6  | 6       | 50            | 50  | 100 | 100   | 3 hours                |
|       |           |                                      |          |        |         |               |     |     |       |                        |
|       | 20EECW494 | <a href="#">Internship- Project</a>  | PRJ      | 0-0-11 | 11      | 50            | 50  | 100 | 100   | 3 hours                |
|       |           |                                      |          |        |         |               |     |     |       |                        |
| 4     | 20EECW402 | <a href="#">Capstone Project</a>     | PRJ      | 0-0-11 | 11      | 50            | 50  | 100 | 100   | 3 hours                |
| TOTAL |           |                                      |          | 6-0-11 | 17      |               | 150 | 150 | 300   |                        |

| Semester | I  | II | III | IV | V  | VI | VII | VIII | Total |
|----------|----|----|-----|----|----|----|-----|------|-------|
| Credits  | 21 | 23 | 22  | 22 | 24 | 24 | 23  | 17   | 176   |



### List of Open Electives

| Sr. No | Name of the Course                     | Course Code |
|--------|----------------------------------------|-------------|
| 1      | <a href="#">Automotive Electronics</a> | 18EECO403   |

### List of Program Electives

| Sr.No | Name of the Course                                          | Course Code |
|-------|-------------------------------------------------------------|-------------|
| 1     | <a href="#">Analog Integrated Circuit Design</a>            | 24EECE301   |
| 2     | <a href="#">Architectural Design of Integrated Circuits</a> | 24EECE302   |
| 3     | <a href="#">Embedded Intelligent Systems</a>                | 24EECE310   |
| 4     | <a href="#">OOPS using C++</a>                              | 25EECE421   |
| 5     | <a href="#">Multimodal Machine Learning</a>                 | 25EECE327   |
| 6     | <a href="#">Dynamics of Linear Systems</a>                  | 24EECE341   |
| 7     | <a href="#">System Verilog for Verification</a>             | 25EECE418   |
| 8     | <a href="#">Multimedia Communication</a>                    | 18EECE410   |
| 9     | <a href="#">Physical Design-Analog</a>                      | 25EECE419   |
| 10    | <a href="#">CMOS ASIC Design</a>                            | 25EECE420   |
| 11    | <a href="#">AUTOSAR</a>                                     | 25EECE406   |
| 12    | <a href="#">Human Machine Interface</a>                     | 25EECE428   |
| 13    | <a href="#">Microwave &amp; Antennas</a>                    | 23EECE411   |
| 14    | <a href="#">Wireless &amp; Mobile Communication</a>         | 24EECE432   |
| 15    | <a href="#">Speech Processing</a>                           | 24EECE422   |
| 16    | <a href="#">Product and Functional Safety</a>               | 24EECE433   |
| 17    | <a href="#">5G and Software Defined Networking</a>          | 24EECE434   |
| 18    | <a href="#">Advance IC Packaging</a>                        | 25EECE436   |
| 19    | <a href="#">Design for Testability</a>                      | 25EECE447   |
| 20    | <a href="#">Signal and Power Integrity</a>                  | 25EECE448   |
| 21    | <a href="#">Advanced DFT</a>                                | 25EECE449   |
| 22    | <a href="#">Multi sensor Data Fusion</a>                    | 25EECE453   |
| 23    | Agentic AI                                                  | 25EECE438   |

### List of Swayam Courses

| Sr.No | Name of the Course                                                                                    | Course Code |
|-------|-------------------------------------------------------------------------------------------------------|-------------|
| 01    | <a href="#">Cloud Computing</a>                                                                       | 22EECE444   |
| 02    | <a href="#">Fabrication Techniques for MEMs-based Sensors:<br/>Clinical Perspective</a>               | 25EECE442   |
| 03    | <a href="#">Cyber Security and Privacy</a>                                                            | 23EECE439   |
| 04    | <a href="#">Phase-Locked Loops</a>                                                                    | 22EECE432   |
| 05    | <a href="#">VLSI Design Flow: RTL to GDS</a>                                                          | 23EECE435   |
| 06    | <a href="#">Computer Vision</a>                                                                       | 25EECE443   |
| 07    | <a href="#">C-Based VLSI Design</a>                                                                   | 23EECE436   |
| 08    | <a href="#">Fundamentals of Micro and Nanofabrication</a>                                             | 23EECE438   |
| 09    | <a href="#">Software Testing</a>                                                                      | 25EECE446   |
| 10    | <a href="#">Applied Linear Algebra for Signal Processing, Data<br/>Analytics and Machine Learning</a> | 23EECE437   |
| 11    | <a href="#">Introduction to Adaptive Signal Processing</a>                                            | 25EECE448   |
| 12    | <a href="#">Introduction to Algorithms and Analysis</a>                                               | 23EECE440   |
| 13    | <a href="#">Cryptography And Network Security</a>                                                     | 22EECE431   |
| 14    | <a href="#">RFIC Design</a>                                                                           | 25EECE449   |

### Curriculum Content- Course wise

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                    |                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics and Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    | <b>Semester: I</b>               |
| <b>Course Title: Single Variable Calculus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    | <b>Course Code:18EMAB101</b>     |
| <b>L-T-P:4-1-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits:5</b>                   | <b>Contact Hours:6 hrs./week</b> |
| <b>ISA Marks:50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>ESA Marks:50</b>                | <b>Total Marks:100</b>           |
| <b>Teaching Hours:50 hrs.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Examination Duration:3 hrs.</b> |                                  |
| <b>Unit I</b><br><b>1. Functions, Graphs and Models</b><br>Functions, types of functions, transformations and models (Linear, exponential, trigonometric).<br>MATLAB: Graphing functions, Domain-Range and Interpreting the models<br><b>2. Calculus of functions and models</b><br>Limit of a function, Infinite limits- graph, Continuity and discontinuity, Intermediate value theorem statement, Roots of the equation using Bisection Method and Newton- Raphson Method<br>Interpretation of derivative as a rate of change, All the rules of derivatives (List only), Maxima, Minima and optimization problems. Curvature and Radius of Curvature, Indeterminate forms, L- Hospital's Rule-Examples<br>MATLAB: optimization problems. Curvature problems          |                                    |                                  |
| <b>Unit II</b><br><b>3. Infinite Series</b><br>Definition, Convergence of series, Tests of convergence – p-series, Alternating series. Power series, radius of convergence, Taylor's and Maclaurin's series, Applications of Taylor's and Maclaurin's series<br>MATLAB: Convergence of series<br><b>4. Integral calculus</b><br>Tracing of standard curves in Cartesian form, Parametric form and Polar form; Beta and gamma function, relation between them, evaluation of integrals using Beta and gamma functions; Applications to find arc length, Area, Volume and surface area (Cartesian, parametric and polar curves). Approximate integration- Trapezoidal rule, Simpson's $\frac{1}{3}$ rule<br>MATLAB: problems on arc length, area, volume and surface area |                                    |                                  |
| <b>Unit III</b><br><b>5. Ordinary differential equations of first order</b><br>(a) Introduction to Initial Value problems. Linear and Bernoulli's equations, Exact equations and reducible to exact form, Numerical solution to Initial Value Problems-Euler's method, Modified Euler's method and Runge-Kutta method<br>(b) Applications of first order differential Equations-Orthogonal trajectories growth and decay problems, mixture problems, Electrical circuits, falling bodies.<br>MATLAB: Solve differential equations                                                                                                                                                                                                                                       |                                    |                                  |
| <b>Text Books</b><br>Early Transcendentals Calculus- James Stewart, Thomson Books, 7ed 2010.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| <b>Reference Books:</b><br>1. Calculus Single and Multivariable, Hughues-Hallett Gleason, Wiley India Ed, 4ed, 2009.<br>2. Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                  |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics and Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                    | <b>Semester: I</b>               |
| <b>Course Title: Engineering Physics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    | <b>Course Code:22EPHB101</b>     |
| <b>L-T-P:3-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Credits:3</b>                   | <b>Contact Hours:3 hrs./week</b> |
| <b>ISA Marks:50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>ESA Marks:50</b>                | <b>Total Marks:100</b>           |
| <b>Teaching Hours:50 hrs.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Examination Duration:3 hrs.</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |
| <b>Chapter 1: Conduction in semiconductors</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| Atomic theory: The atom, electron orbits and energy levels, energy bands, Conduction in solids: Electron motion and hole transfer, conventional current and electron flow<br>Conductors, semiconductors and insulators: Bonding force between atoms, Energy bands in different materials.<br>n-type and p-type Semiconductors: Doping, n-Type material, p-Type material, Majority and minority charge carriers, Effects of heat and light, charge carrier density.<br>Semiconductor conductivity: Drift current, diffusion current, charge carrier velocity, conductivity, Hall Effect.<br>(Text 1 Page No 1-33)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                                  |
| <b>Chapter 2: Junctions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    |                                  |
| The pn-Junctions: Junction of p-Type and n-Type, Barrier voltage, depletion region, Qualitative theory of p-n Junction<br>Biased junctions: Reverse biased junction, forward biased junction, junction temperature effects.<br>Junction currents and voltages: Shockley equation, junction currents, junction voltages.<br>p-n Junction Diode characteristics and parameters: Forward and reverse characteristics, diode parameters.<br>Diode approximations: Ideal diode and practical diodes, piecewise linear characteristics, DC equivalent circuits.<br>DC load line analysis: DC load line, Q-Point, calculating load resistance and supply voltage.<br>Temperature Effects: Diode power dissipation, forward voltage drops, dynamic resistance.<br>Diode AC models: Junction capacitance, AC-equivalent circuits (Reverse biased and forward biased), reverse recovery time.<br>Diode specifications: Diode data sheets, low power diodes, rectifier diodes<br>Diode testing: Ohmmeter tests, use of digital meter, plotting diode characteristics.<br>Zener diodes: Junction break down, circuit symbols and packages, characteristics and parameters, data sheet, equivalent circuits.<br>(Text 1 Page No 34-71) |                                    |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| <b>Chapter 3: Electrostatics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                                  |
| Review on vectors:<br>Coordinate Systems, Vector and Scalar Quantities, Properties of Vectors, Components of a Vector and Unit Vectors<br>(Text 2 Page No 59-77)<br>Electric Fields:<br>Properties of Electric Charges, Charging Objects by Induction, Coulomb's Law, Analysis Model: Particle in a Field (Electric), Electric Field of a Continuous Charge Distribution, Electric Field Lines Motion of a Charged Particle in a Uniform Electric Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                  |

**Gauss's Law:**

Electric Flux, Gauss's Law, Application of Gauss's Law to Various Charge Distributions, Conductors in Electrostatic Equilibrium

**Electric Potential:**

Electric Potential and Potential Difference, Potential Difference in a Uniform Electric Field, Electric Potential and Potential Energy Due to Point Charges, Obtaining the Value of the Electric Field from the Electric Potential, Electric Potential Due to Continuous Charge Distributions  
Electric Potential Due to a Charged Conductor, Applications of Electrostatics

**Capacitance and Dielectrics:**

Definition of Capacitance, Calculating Capacitance, Combinations of Capacitors, Energy Stored in a Charged Capacitor, Capacitors with Dielectrics, Electric Dipole in an Electric Field, An Atomic Description of Dielectrics

(Text 2 Page No 690-807)

**Unit III**
**Chapter 4: Electromagnetics**
**Magnetic Fields:**

Analysis Model: Particle in a Field (Magnetic), Motion of a Charged Particle in a Uniform Magnetic Field, Applications Involving Charged Particles Moving in a Magnetic Field, Magnetic Force Acting on a Current-Carrying Conductor, Torque on a Current Loop in a Uniform Magnetic Field,

**Sources of the Magnetic Field:**

The Biot–Savart Law, The Magnetic Force Between Two Parallel Conductors, Ampere's Law, The Magnetic Field of a Solenoid, Gauss's Law in Magnetism, Magnetism in Matter

**Faraday's Law:**

Faraday's Law of Induction, Motional emf, Lenz's Law, Induced emf and Electric Fields  
Generators and Motors, Eddy Currents (Text 2 Page No 868-969)

**Text Books**

1. David A Bell, "Electronics Devices and Circuits", Fifth Edition, Oxford University Press.
2. Serway and Jewett, "Physics for Scientists and Engineers-with Modern Physics", 9<sup>th</sup> Edition, CENGAGE learning. 2014

**Reference Books:**

1. Jacob Millman and Christos Halkias, "Electronic Devices and Circuits" TMH
2. R P Feynman, Robert B Leighton, Matthew Sands, The Feynman Lectures on Physics Vol-II, Norosa Publishing House (1998).
3. Ben G Streetman, Solid State Electronic Devices, Prentice Hall, 1995

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|-------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: I</b>               |
| <b>Course Title: Engineering Mechanics</b>                  |                                    | <b>Course Code: 15ECVF101</b>    |
| <b>L-T-P: 4-0-0</b>                                         | <b>Credits: 4</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 50</b>                                        | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                | <b>Examination Duration: 3 Hrs</b> |                                  |

## Unit I

### Chapter 1: Overview of Civil Engineering

Evolution of Civil Engineering

Specialization, scope and role.

Impact of Civil Engineering on

National economy, environment and social & cultural fabric.

Challenges and Opportunities for Civil Engineers

Civil Engineering Marvels, Future challenges, Higher education and Research.

### Chapter 2: Coplanar concurrent force system

Introduction to Engineering Mechanics:

Basic idealizations – Particle, Continuum, Body, Rigid body, Deformable body, Definition of force and its elements; Laws of Mechanics – Parallelogram law of forces, Principle of transmissibility, Law of Superposition,

Newton's laws of motion. Classification of force systems Resultant of coplanar concurrent force system: Definitions – Resultant, composition & Resolution of a force, Equilibrium, Equilibrant, Formulae for resultant of forces and resolution of a force. Numerical problems on resultant of forces.

Equilibrium of coplanar concurrent force system:

Conditions of equilibrium, Action & Reaction, Free body diagram, Lami's theorem. Numerical problems on equilibrium of forces.

### Chapter 3 : Coplanar non-concurrent force system

Resultant of a force system: Moment, moment of a force, couple, moment of a couple, Characteristics of couple, Equivalent force-couple system, Numerical problems on moment of forces and couples, on equivalent force-couple system. Varignon's principle of moments, Resultant of coplanar- non-concurrent force systems and numerical problems.

## Unit II

### 4 Coplanar Non - Concurrent Force System (Equilibrium)

Conditions of equilibrium, types of support and loading for a statically determinate beam, Reactions at support connections, Numerical problems on equilibrium of force systems and support reactions for a statically determinate beam.

### 5. Friction

Introduction, types of friction, definition, limiting friction, coefficient of friction, laws of Coulomb friction, angle of friction and angle of repose, cone of friction. Wedge theory. Numerical problems on, impending

motion on horizontal and inclined planes (including connected bodies); wedge friction and Ladder friction.

## 6. Simple Stress and Strain

Introduction, Properties of Materials, Stress, Strain, Elasticity, Elastic limit, Hooke's law & Young's modulus, Stress–Strain Diagram for structural steel, working stress, and Factor of safety. Deformation of a bar due to force acting on it. Law of superposition. Stresses in bars of uniform & varying cross sections. Composite sections. Problems connected to above topics.

## Unit III

### Chapter 7: Centroid of Plane Figures

Introduction, Definition, Methods of determining the centroid, axis of reference, axis of symmetry, Locating the centroid of simple plane figures (triangle, semicircle, quarter of a circle and sector of a circle etc.,) using method of integration, Numerical problems on Centroid of simple built-up sections.

### Chapter 8: Second moment of area (Plane figures)

Introduction, Definition, Method of determining the second moment of area, Section Modulus, Radius of gyration, perpendicular and Parallel axis theorems, Polar second moment of area, second moment of area of simple plane figures (triangle, rectangle, semicircle, circle etc.,) using method of integration, Numerical problems on MI of simple built up sections.

## Text Books

1. Bhavikatti, S.S., Engineering Mechanics, 6th., New Age International Pub. Pvt. Ltd., New Delhi, 2018
2. Kumar, K.L., Veenu Kumar., Engineering Mechanics, 4th, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Jagadeesh, T.R. and Jayaram, Elements of Civil Engineering, 1ed, Sapna Book House, Bangalore, 2006

## Reference Books:

1. Beer, F.P. and Johnston, R., Vector Mechanics for Engineers: Statics and dynamics, 12Ed., McGraw Hill Company, New York, 2019
2. Singer, F.L., Engineering Mechanics, 3Ed., Harper Collins, 1994
3. Timoshenko, S.P. and Young D.H., Engineering Mechanics (In SI Units), 5Ed., McGraw Hill Publishing Company, New Delhi, 2017
4. Irving H Shames, G Krishna Mohana Rao, Engineering Mechanics Statics and dynamics, 4Ed., Prentice-Hall of India Pvt. Ltd, New Delhi, 2005
5. Ramamrutham, S., Engineering Mechanics, Dhanpat Rai Publishing Co., New Delhi, 2016

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                  |                                    | <b>Semester: I</b>               |
| <b>Course Title: C Programming for Problem solving</b>                                                                                                                                                                                                                                                                       |                                    | <b>Course Code: 18ECSP101</b>    |
| <b>L-T-P: 0-0-3</b>                                                                                                                                                                                                                                                                                                          | <b>Credits: 3</b>                  | <b>Contact Hours: 6 hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                         | <b>ESA Marks: 20</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 78Hrs</b>                                                                                                                                                                                                                                                                                                 | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Introduction to Problem solving:</b> Introduction to algorithms / flowcharts and its notations, top down design, elementary problems.                                                                                                                                                                                     |                                    |                                  |
| <b>Basics of C programming language:</b> Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements.                                                                                                                   |                                    |                                  |
| <b>Decision control statements:</b> Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements: break, continue.<br>Introduction to Debugging Skills, Introduction to Test Driven Programming.                                                  |                                    |                                  |
| <b>Iterative statements:</b> while, do while, for, nested statements                                                                                                                                                                                                                                                         |                                    |                                  |
| <b>Functions:</b> Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, introduction to macros. Introduction to Coding Standards                                                                                                                                         |                                    |                                  |
| <b>Arrays and Strings:</b> Introduction, Declaration, accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays, Introduction to Code Optimization and refactoring                                                                                             |                                    |                                  |
| <b>Pointers:</b> Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function.                                                                                                                  |                                    |                                  |
| <b>Structures and Unions:</b> Introduction, passing structures to functions, Array of structures, Unions                                                                                                                                                                                                                     |                                    |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"><li>1. R.G. Dromey, how to Solve it by Computer, 1ed, PHI, 2008.</li><li>2. Yashvant Kanetkar, Let us C ,15<sup>th</sup> ed, BPS Publication, 2016.</li></ol>                                                                                                            |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. B W Kernighan, D M Ritchie, The Programming Language C, 2ed, PHI, 2004.</li><li>2. B S Gottfried, Programming with C, 2ed, TMH, 2006.</li><li>3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.</li></ol> |                                    |                                  |

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|-------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: I</b>               |
| <b>Course Title: Basic Electrical Engineering</b>           |                                    | <b>Course Code: 18EEEF101</b>    |
| <b>L-T-P: 3-0-0</b>                                         | <b>Credits: 3</b>                  | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                        | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                | <b>Examination Duration: 3 Hrs</b> |                                  |

## Unit I

### Overview of Electrical Engineering

Specialization, scope & role, impact of Electrical Engineering on national economy, environment, Sources of generation, sustainability, challenges and opportunities for electrical engineers, electrical engineering marvels, future challenges.

### DC Circuits

Voltage and current sources, Kirchoff's current and voltage laws, loop and nodal analysis of simple circuits with dc excitation. Time-domain analysis of first-order RL and RC circuits.

### AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase series and parallel R-L-C ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections. power measurement using two watt meters

## Unit II

### Electrical Actuators

Electromagnetic principles, Solenoid, Relays, classification of Electric motors, DC motors-shunt, series, compound, separately excited, PMDC motors – Speed Control, Stepper Motors, BLDC motors, three phase induction motor, Characteristics and applications, selection of motors for various applications.

### Power Electronics (Text1, chapter 45)

Introductory, Thyristor, some thyristor circuits, Limitations to thyristor operation, the thyristor in practice, the fully controlled AC/DC converter, AC/DC inversion, switching devices in inverters, Three-phase rectifier networks, the three-phase fully controlled converter, Inverter-fed induction motors, Soft-starting induction motors, DC to DC conversion switched-mode power.

## Unit III

### Electrical Wiring, Safety and protection (Ref: Text3-page 1 to 10)

Types of wires and cables for internal wiring, Types of switches and Circuits, Types of wiring, Safety precautions and rules in handling electrical appliances, Electric shock, first aid for electrical shocks, Importance of grounding and earthing, Methods for earthing, Fuses, MCB, ELCB and Relays, Lockout and Tagout, Electrical Codes and Standards.

### Batteries:

Basics of lead acid batteries, Lithium Ion Battery, Battery storage capacity, Coulomb efficiency, Numerical of high and low charging rates, Battery sizing. Numericals.



#### **Text Books**

1. Hughes, Electrical & Electronic Technology, 8<sup>th</sup>, Pearson Education, 2001
2. P C Sen, Principals of Electrical Machines and Power Electronics, 2nd, Wiley Publications
3. Gilbert M Masters, Renewable and efficient Electrical Power systems, Published by John Wiley & Sons 2004 edition
4. Frank D. Petronella, Electric Motors and Control Systems, McGraw Hill Education Private Limited 2009 Edition

#### **Reference Books:**

1. D C Kulshreshtha, Basic Electrical Engineering, Mc Graw Hill Publications
2. David G Alciatore and Michel B Histan, Introduction to Mechatronics and Measurement Systems, 3rd, Tata McGraw Hill Education Private Limited, New Delhi., 2005
3. Vincent Del Toro, Electrical Engineering Fundamentals, 2<sup>nd</sup> edition Prentice Hall India

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| Program: Electronics & Communication Engineering    |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Semester: I                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
|-----------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Course Title: Design Thinking for Social Innovation |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Course Code: 20EHSP101                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| L-T-P: 0-1-1                                        |                      | Credits: 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contact Hours: 4 hrs/week                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| ISA Marks: 80                                       |                      | ESA Marks: 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Total Marks: 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| Teaching Hours: 28Hrs                               |                      | Examination Duration: 3 Hrs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| Module                                              |                      | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Assignments                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Support activities / Tools                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
| KNOWLEDGE, TOOLS & DEVELOPMENT                      | Course sensitization | 1. Introduction to Social Innovation: <ul style="list-style-type: none"><li>Awakening social consciousness</li></ul> <p>(www.yourstory.com)</p> <ul style="list-style-type: none"><li>Social Innovation and Leadership</li><li>Engineering&amp; Social innovation (EPICS)</li></ul> <p>(Connecting SI Course to Mini Project, Capstone Project, Campus Placements)</p> <ul style="list-style-type: none"><li>Course Overview</li><li>Students’ Self Introduction Activity</li><li>Group formation</li></ul> <p>Activity</p> | <u>Reading assignments</u> <ul style="list-style-type: none"><li>Read the handout on “The Process of Social Innovation” by Geoff Mulgan</li><li>Design thinking for Social Innovation</li></ul> <u>Written Assignments</u> <ul style="list-style-type: none"><li>Writing about Akshaya Patra in class.<br/>(Background information about Akshaya patra and the Social Cause it is addressing)</li><li>Brainstorming Session on Social Innovators in Class</li></ul> | <ul style="list-style-type: none"><li>Class activity on Behavioural Blocks to Innovation</li></ul> <p><b>Discussion on the behavioural blocks.</b></p> <ul style="list-style-type: none"><li>Introducing oneself with three Adjectives- Appreciating diversities and discovering self</li><li>Group Formation Activity</li></ul> <p>(Forming square)</p> <p>(Making four equilateral triangles out of popsicle sticks to enhance group cohesiveness amongst the group mates)</p> |  |
|                                                     |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |

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|  | Create Mindsets              | <p><b>Seven Mindsets:</b></p> <ol style="list-style-type: none"> <li>1. Empathy<br/><b>(Example of The Boy and the Puppies)</b></li> <li>2. Optimism<br/><b>(Person Paralyzed waist down / Glass Half Full Half Empty)</b></li> <li>3. Iteration<br/><b>(Thomas Alva Edison)</b></li> <li>4. Creative Confidence<br/><b>(Origami – Josef Albers)</b></li> <li>5. Making it</li> <li>6. Embracing Ambiguity<br/><b>(Confusion is the Welcome doormat at the door of Creativity)</b></li> <li>7. Learning from Failure<br/><b>(Designing Website first and then asking the stakeholders about the website)</b></li> </ol> <p><b>(Spending one lakh for the business which is never launched)</b></p> | <p><u><b>Reading assignments</b></u></p> <ul style="list-style-type: none"> <li>• Handout on “Create Mindsets”</li> </ul>         | <ul style="list-style-type: none"> <li>• <b>(How to train the Dragon?</b><br/><b>Common Video for all the mindsets)</b></li> <li>• <b>Watching in Class TED Talk on “How to build your Creative Confidence by David Kelley – IDEO Founder)</b></li> </ul> |
|  | Process of Social Innovation | <p><b>Engage</b></p> <p>Community study and Issue Identification</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><u><b>Reading assignments</b></u></p> <ul style="list-style-type: none"> <li>• Handout on Community Study and Issue</li> </ul> | <ul style="list-style-type: none"> <li>• Activity on Observation skills</li> </ul> <p>To know how to use one’s observation skills in understanding the</p>                                                                                                |

|  |  |                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                      |
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|  |  |                                                                                                                                                                                | <p>Identification</p> <ul style="list-style-type: none"><li>• Case Study on “EGramSeva”</li><li>• Case Study on “Janani Agri Serve”</li></ul> <p><b><u>Class Presentations</u></b></p> <ul style="list-style-type: none"><li>• Initial observations being made by the group</li></ul> <p><b>(Literature Survey of Places of Hubli-Dharwad)</b></p> <p><b>www.readwhere.com</b></p> <ul style="list-style-type: none"><li>• Detailed interaction / engagements with the society and finalize the social issue for intervention</li></ul> <p><b>Use template 1: Frame your Design Challenge</b></p> | <p>social conditions</p> <ul style="list-style-type: none"><li>• Experience sharing by senior students</li><li>• Brainstorming</li><li>Deliberations on the initial observations and arrive at the “Social Issue”</li><li>• Familiarization of the respective templates with the help of sample case study</li></ul> |
|  |  | <b>PEER REVIEW</b>                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                      |
|  |  | <p><b>2. Inspiration</b></p> <ul style="list-style-type: none"><li>• Plan for the Research</li><li>• Development of Interview guide</li><li>• Capture your Learnings</li></ul> | <p><b><u>Reading assignments</u></b></p> <ul style="list-style-type: none"><li>• Handout on Overview of Inspiration</li></ul> <p><b><u>Class Presentations</u></b></p> <ul style="list-style-type: none"><li>• Entirety of the Social Issue</li><li>• Identification of the Stake Holders</li></ul> <p><b>(Examples on Fluorescent Curtain and Students’</b></p>                                                                                                                                                                                                                                  | <ul style="list-style-type: none"><li>• Familiarization of the respective templates with the help of sample case study</li></ul>                                                                                                                                                                                     |

|  |  |                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                    |
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|  |  |                                                                                                                                                         | <b>Punctuality for Class)</b> <ul style="list-style-type: none"> <li>Interview Questions</li> </ul> <b>(Role Play on Interview with Stakeholders)</b> <ul style="list-style-type: none"> <li>Category wise Learnings capture</li> </ul> <b>Use template 2: Plan your Research</b><br><b>Template 3. Development of Interview Guide</b><br><b>Template 4. Capture your Learning</b> |                                                                                                                                                                                    |
|  |  | <b>3. Ideation</b><br><b>3.1 Synthesis</b> <ul style="list-style-type: none"> <li>Search for meaning</li> <li>Create “How might we” question</li> </ul> | <u><b>Reading assignments</b></u> <ul style="list-style-type: none"> <li>Handout on Overview of Ideation-Synthesis</li> </ul> <u><b>Class Presentations</b></u> <ul style="list-style-type: none"> <li>Create insights</li> <li>“How might we” questions</li> </ul> <b>Use template 5: Create Insights</b><br><b>Template 6: Create “How Might We’ Questions</b>                   | <ul style="list-style-type: none"> <li>Familiarization of the respective templates with the help of sample case study</li> </ul>                                                   |
|  |  | <b>3.0 Ideation</b><br><b>3.2 Prototyping</b> <ul style="list-style-type: none"> <li>Generate Ideas</li> </ul>                                          | <u><b>Reading assignments</b></u> <ul style="list-style-type: none"> <li>Handout on Overview of Ideation-Prototyping</li> </ul> <u><b>Class Presentations</b></u> <ul style="list-style-type: none"> <li>Story board-</li> </ul>                                                                                                                                                   | <ul style="list-style-type: none"> <li>Brain storming</li> <li>Familiarization of the respective templates with the help of sample case study</li> <li>Activity on Risk</li> </ul> |

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|  |  | <ul style="list-style-type: none"> <li>Select Promising Ideas</li> <li>Determine what to prototype</li> <li>Make your prototype</li> <li>Test and get feedback</li> </ul>                                                                                                                                                                                                                                                                                                   | <p>demonstrating the possible solutions</p> <p><b>Use template 7: Select your best ideas</b></p> <p><b>Template 8 : Determine what to prototype</b></p>                                                                                                                                                                                  | <p>management</p> <ul style="list-style-type: none"> <li>Activity on Resource management</li> <li>Structure building games</li> </ul> |
|  |  | <b>PEER REVIEW</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                       |
|  |  | <p><b>4.0 Implementation</b></p> <ul style="list-style-type: none"> <li>Create an action plan</li> <li>Community Partners (if any)</li> <li>Budgeting &amp; Fundraising</li> </ul> <ol style="list-style-type: none"> <li>Peer to Peer</li> <li>Crowd Funding</li> <li>Giving Kiosks</li> <li>Donation</li> <li>Envelop Funding</li> <li>Marathons/ Walkathons</li> <li>Conducting Yoga Classes</li> </ol> <p>(<a href="http://www.causevox.com">www.causevox.com</a> /</p> | <p><u><b>Reading assignments</b></u></p> <ul style="list-style-type: none"> <li>Handout on Overview of Implementation</li> </ul> <p><u><b>Class Presentations</b></u></p> <ul style="list-style-type: none"> <li>Pilot implementation plan with required resources and Budget indicating stake holders &amp; their engagement</li> </ul> | <ul style="list-style-type: none"> <li>Familiarization of the respective templates with the help of sample case study</li> </ul>      |

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|  |  | <b>www.blog.fundly.com)</b> <ul style="list-style-type: none"> <li>• Duration</li> <li>• Ethical concerns</li> <li>• Launch your solution</li> <li>• Feedback (Impact)</li> </ul> |                                                                                                                                                                                                                                                                     |                                                                                                                                    |
|  |  | <b>5.0 Reflect</b><br><br>Reflection of the overall learning by the students                                                                                                      | <u><b>Reading assignments</b></u> <ul style="list-style-type: none"> <li>• Handout on Overview of students Reflection</li> </ul> <b>Use template 9: Reflection on the Process</b><br><br><u><b>Class Presentations</b></u> Final Presentation- After Implementation | <ul style="list-style-type: none"> <li>• Familiarization of the respective templates with the help of sample case study</li> </ul> |

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|-------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b>                                     |                                    | <b>Semester: I</b>               |
| <b>Course Title: Applied Physics lab</b>                                                        |                                    | <b>Course Code: 21EPHP101</b>    |
| <b>L-T-P: 0-0-1</b>                                                                             | <b>Credits: 1</b>                  | <b>Contact Hours: 2 hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                            | <b>ESA Marks: 20</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 24Hrs</b>                                                                    | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>List of Experiments</b>                                                                      |                                    |                                  |
| 1. Use of measuring instruments (RPS & FG) and calibration of the oscilloscope                  |                                    |                                  |
| 2. Energy band gap of a semiconductor by the Four-Probe Method                                  |                                    |                                  |
| 3. Dielectric constant of capacitor by charging and discharging of a capacitor                  |                                    |                                  |
| 4. Selectivity of tuned circuits and frequency response of LCR circuits                         |                                    |                                  |
| 5. V-I Characteristics of pn- Junction diode and plotting DC load line                          |                                    |                                  |
| 6. Zener diode characteristics and voltage regulation (line and load regulation).               |                                    |                                  |
| 7. V-I Characteristics of BJT (Input and output characteristics in CE mode).                    |                                    |                                  |
| 8. Realization of single-phase rectifier circuit (HW, FW Y& FW Bridge) with and without filters |                                    |                                  |
| 9. Realization of basic gates (Using IC's)                                                      |                                    |                                  |
| 10. Verification of Kirchoff's KVL and KCL (DC Circuits)                                        |                                    |                                  |
| <b>OPEN ENDED EXPERIMENT</b>                                                                    |                                    |                                  |
| 1. Realization of a $\pm 5/12V$ regulated power supply                                          |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    | <b>Semester: II</b>              |
| <b>Course Title: Multivariable calculus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    | <b>Course Code: 18EMAB102</b>    |
| <b>L-T-P: 4-1-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Credits: 5</b>                  | <b>Contact Hours: 6 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b> <ol style="list-style-type: none"> <li><b>Partial differentiation</b><br/>Function of several variables, Partial derivatives, Level curves, Chain rule, Errors and Approximations. Extreme value problems. Lagrange's multipliers.</li> <li><b>Double integrals</b><br/>Double integrals- Rectangular and polar coordinates, Change the order of integration. Change of variables, Jacobian. Application of double integrals</li> </ol> MATLAB: optimization problems, application of double integrals                                                            |                                    |                                  |
| <b>Unit II</b> <ol style="list-style-type: none"> <li><b>Triple integrals</b><br/>Triple integrals, Cartesian, change to Cylindrical and Spherical Coordinates Application of Triple integrals</li> <li><b>Calculus of Vector Fields</b><br/>Vector fields, Gradient and directional derivatives. Line and Surface integrals. Independence of path and potential functions. Green's theorem, Divergence of vector field, Divergence theorem, Curl of vector field. Stokes theorem.</li> </ol> MATLAB: application of Triple integrals, Vector calculus problems                 |                                    |                                  |
| <b>Unit III</b> <ol style="list-style-type: none"> <li><b>Differential equations of higher orders</b><br/>(a) Linear differential equations of second and higher order with constant coefficients. The method of Variation of parameters. Initial and boundary value problems.<br/>(b) Applications of second order differential Equations-Newton's 2<sup>nd</sup> law, electrical circuits, Simple Harmonic motion. Series solution of differential equations. Validity of Series solution of Differential equations.</li> </ol> MATLAB: application of differential equations |                                    |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>Early Transcendentals Calculus- James Stewart, Thomson Books, 7ed 2010.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>Calculus Single and Multivariable, Hughes-Hallett Gleason, Wiley India Ed, 4ed, 2009.</li> <li>Thomas Calculus, George B Thomas, Pearson India, 12ed, 2010</li> </ol>                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: II</b>              |
| <b>Course Title: Engineering Chemistry</b>                  |                                    | <b>Course Code: 22ECHB102</b>    |
| <b>L-T-P: 3-0-0</b>                                         | <b>Credits: 3</b>                  | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                        | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                | <b>Examination Duration: 3 Hrs</b> |                                  |

#### Unit I

##### 1. Chemical Bonding and Molecular Structure

Chemical bonding – Types, Ionic bond: Formation of NaCl molecule, factors influencing the formation of ionic bond – ionization energy, electron affinity and lattice energy, Born–Haber’s cycle, calculation of lattice energy of NaCl molecule and properties of ionic compounds; Covalent bond: atomic orbital theory – formation of H<sub>2</sub> molecule, polar and non-polar covalent bonds – H<sub>2</sub> and HCl molecules, dipole moment, calculation of percentage of ionic character and properties of covalent compounds. Hybridization: sp, sp<sup>2</sup> and sp<sup>3</sup> hybridization - geometry of BeF<sub>2</sub>, BF<sub>3</sub> and CH<sub>4</sub> molecules. VSEPR Theory: regular and irregular geometry, geometry of SnCl<sub>2</sub>, NH<sub>3</sub> and H<sub>2</sub>O molecules.

##### 2. Electrochemical Energy Systems

Electrode potential, Nernst equation; Formation of a cell; Reference electrodes: Calomel electrode - determination of electrode potential; Numerical problems on E, E<sub>cell</sub> and E<sup>0</sup><sub>cell</sub>. Batteries: classification, characteristics, Lead-acid battery and Lithium-ion battery. Fuel cells: Types of fuel cells; Methanol - Oxygen fuel cell.

##### 3. Polymer Chemistry

Polymers, properties, classification, and free radical mechanism of addition polymerization by taking ethylene as an example. Commercial polymers: plexiglass and polyurethane. Polymer composites: carbon fiber and epoxy resin – synthesis, properties and applications. Conducting polymers: Polyaniline – synthesis, mechanism of conduction in doped polyaniline and its applications.

#### Unit II

##### 4. Plating Techniques

Technological importance of plating techniques, Types of plating, Electroplating: Definition, electroplating of Gold by acid cyanide bath, determination of Throwing Power of plating bath by Haring Blum cell and numerical problems. Electroless plating: advantages of electroless plating over electroplating, electroless plating of Copper and its application in the manufacture of printed circuit board (PCB).

##### 5. Wafer Technology

Introduction, physical and chemical properties of silicon, metallurgical grade silicon, purification of silicon; chemical vapor deposition (CVD) process, zone refining process. Crystal growth: preparation of single crystal silicon by Czochralski crystal pulling technique and numerical problems. Crystal slicing and wafer preparation; Fabrication process: thermal oxidation, diffusion, ion implantation, numerical problems, epitaxial growth, masking, photolithography; wet etching and dry etching.

##### 6. Material Chemistry

Liquid crystals: classification of liquid crystals, applications of liquid crystals in display systems. Glass:

properties, smart glass: electrochromic, thermochromic and photochromic smart glass - properties and applications. Thermoelectric and Piezoelectric materials - meaning, properties and applications.

#### **Text Books**

1. A text Book of Engineering Chemistry, 1st edition, Dara. S. S, S. Chand and Co. Ltd., 2009, New Delhi.
2. A text Book of Engineering Chemistry, 16<sup>th</sup> edition, Jain P.C and Jain M, Dhanpat Rai Publications, 2006, New Delhi.
3. Engineering Chemistry, 3<sup>rd</sup> Edition, Krishnamurthy. N., Vallinayaga. P. and Madhavan. D., PHI/E- Books Premium, 2014.

#### **Reference Books:**

1. Text book of Inorganic Chemistry, P. L. Soni, Sultan Chand, 1999, New Delhi.
2. Inorganic chemistry: Principles of structure and reactivity, , 4<sup>th</sup> Edition, James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Medhi, Dorling Kindersley (India) Pvt. Ltd., 2006, New Delhi.
3. Concise Inorganic Chemistry ELBS, 5<sup>th</sup> Edition, J.D. Lee, Wiley, 2008, New York.
4. Hand book of batteries, 3<sup>rd</sup> edition, David Linden, Thomas B Reddy, McGraw Hill publications, 2001, New York.
5. Polymer Science, 6<sup>th</sup> edition, Gowariker V.R, Viswanatan N.V, Sreedhar J., New Age International (P) Ltd., 2007, New Delhi.
6. Text Book of Polymer Science, 3<sup>rd</sup> edition, Fred W. Billmeyer, John Wiley and Son's, 1984, New York.
7. VLSI Technology, 2<sup>nd</sup> Edition, S. M. Sze, McGraw-Hill Series in Electrical and Computer Engineering, 1998, New York.
8. Solid State Devices & Technology, 4<sup>th</sup> Edition, V. Suresh Babu, Sanguine Technical Publishers, 2005, Bangalore.
9. Materials Science and Engineering: An introduction, 9<sup>th</sup> Edition, Callister William D, John Wiley and Sons, 2007, New York.
10. Instrumental Methods of Chemical Analysis, 5<sup>th</sup> edition, Gurdeep R Chatwal, Sham K Anand, Himalaya Publishing House, Pvt. Ltd, 2010, Mumbai.

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                          |                                    | <b>Semester: II</b>              |
| <b>Course Title: Problem Solving with Data Structures</b>                                                                                                                                                                                                                                            |                                    | <b>Course Code: 18ECSP102</b>    |
| <b>L-T-P: 0-0-3</b>                                                                                                                                                                                                                                                                                  | <b>Credits: 3</b>                  | <b>Contact Hours: 6 hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                 | <b>ESA Marks: 20</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 78Hrs</b>                                                                                                                                                                                                                                                                         | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Pointers, Structures and Files</b>                                                                                                                                                                                                                                                                |                                    |                                  |
| Recap of basics: Pointers ,Structures; Self-referential structures, dynamic memory management Files – File manipulation programs                                                                                                                                                                     |                                    |                                  |
| <b>Stacks and Recursion</b>                                                                                                                                                                                                                                                                          |                                    |                                  |
| Stack: Definition, Operations, Stack ADT Implementation of stack operations. Applications of stack. Recursion-Need for Recursion and problems on Recursion.                                                                                                                                          |                                    |                                  |
| <b>Queues</b>                                                                                                                                                                                                                                                                                        |                                    |                                  |
| Queue: Definitions of Linear, Circular queues, Queue ADT Linear and circular queue operations Definition and working of Priority queue, Double ended queue; Applications of queues.                                                                                                                  |                                    |                                  |
| <b>Lists</b>                                                                                                                                                                                                                                                                                         |                                    |                                  |
| Concept of lists and dynamic memory management lists, definitions and representations: singly, doubly, circular lists. Dynamic Implementation of lists and its operations, Applications of linked lists                                                                                              |                                    |                                  |
| <b>Binary trees</b>                                                                                                                                                                                                                                                                                  |                                    |                                  |
| Binary Tree: Definition, Terminology and representation, Tree Traversals both recursive and iterative. Binary Search Tree and its applications.                                                                                                                                                      |                                    |                                  |
| <b>Text Books</b>                                                                                                                                                                                                                                                                                    |                                    |                                  |
| <ol style="list-style-type: none"><li>1. Data Structures with C -- Seymour Lipschutz, Schaum's Outline Series</li><li>2. Data Structures Using C and C++ -- Langsam and Tanenbaum, PHI Publication</li><li>3. Data Structures Through C -- Yashavant P Kanetkar, BPB Publication</li></ol>           |                                    |                                  |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                              |                                    |                                  |
| <ol style="list-style-type: none"><li>1. B W Kernighan, D M Ritchie, The Programming Language C, 2ed, PHI, 2004.</li><li>2. B S Gottfried, Programming with C, 2ed, TMH, 2006.</li><li>3. B.A. Forouzan, R.F. Gilberg, A Structured Program Approach Using C, 3ed, CENGAGE Learning, 2008.</li></ol> |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                    |                                    | <b>Semester: II</b>              |
| <b>Course Title: Engineering Exploration</b>                                                                                                                                                                                                                                                   |                                    | <b>Course Code: 22ECRP101</b>    |
| <b>L-T-P: 0-0-3</b>                                                                                                                                                                                                                                                                            | <b>Credits: 3</b>                  | <b>Contact Hours: 6 hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                           | <b>ESA Marks: 20</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 78Hrs</b>                                                                                                                                                                                                                                                                   | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Module 1: Introduction to Engineering and Engineering Study</b>                                                                                                                                                                                                                             |                                    |                                  |
| Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants various disciplines of engineering, some misconceptions of engineering, Expectation for the 21 <sup>st</sup> -century engineer, and Graduate Attributes. |                                    |                                  |
| <b>Module 2: Engineering Design</b>                                                                                                                                                                                                                                                            |                                    |                                  |
| Engineering Design Process, Problem definition formulation process, Concept generation- Function tree, Functional structure, Morphological chart, and Concept selection- Pugh Chart, Product Architecture. Prototyping and testing.                                                            |                                    |                                  |
| <b>Module 3: Mechanisms and Resource Specifications (MRS)</b>                                                                                                                                                                                                                                  |                                    |                                  |
| Mechanism, types of mechanisms, degree of freedom, linkages, four-bar linkage mechanism, actuators & their types, torque, governing equations, FOS, motor sizing, motor selection, mass acquisition using software, power adapters, types of adapters, power calculations & adapter selection. |                                    |                                  |
| <b>Module 4: Platform-Based development</b>                                                                                                                                                                                                                                                    |                                    |                                  |
| Introduction to various platform-based development (Arduino) programming and its essentials, Introduction to sensors, transducers, and actuators and its interfacing with Arduino.                                                                                                             |                                    |                                  |
| <b>Module 5. Project Management</b>                                                                                                                                                                                                                                                            |                                    |                                  |
| Introduction to Project Management, Significance of teamwork, Significance of Agile practices, Significance of documentation.                                                                                                                                                                  |                                    |                                  |
| <b>Module 6. Engineering Ethics</b>                                                                                                                                                                                                                                                            |                                    |                                  |
| Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers, Identifying Ethical Dilemmas in different tasks of engineering, Applying Moral Theories and codes of conduct for resolution of Ethical Dilemmas                                   |                                    |                                  |
| <b>Module 7. Sustainability in Engineering</b>                                                                                                                                                                                                                                                 |                                    |                                  |
| Introduction to sustainability, Sustainability leadership, Life cycle assessment, carbon foot print.                                                                                                                                                                                           |                                    |                                  |
| Course Project                                                                                                                                                                                                                                                                                 |                                    |                                  |
| Reviews                                                                                                                                                                                                                                                                                        |                                    |                                  |

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|-------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: II</b>              |
| <b>Course Title: Basic Electronics</b>                      |                                    | <b>Course Code: 18EECF101</b>    |
| <b>L-T-P: 4-0-0</b>                                         | <b>Credits: 4</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 50</b>                                        | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                | <b>Examination Duration: 3 Hrs</b> |                                  |

#### Unit I

##### Chapter 1: Trends in Electronic Industries:

Introduction, Roadmap of electronic sector, scope and opportunities in various segments of electronics (i.e., Consumer, Telecom, IT, Defense, Industrial, Medical and Automobiles), Government and private sectors, Growth profile of Electronic industries, Standards and Policies, Electronic System Components.

##### Chapter 2: Basic Components, Devices and Applications:

Diode: PN junction characteristics; modeling as a circuit element, ideal and practical diode. AC to DC converter: Half wave and full wave rectifier (centre tap and bridge), capacitor filter and its analysis, numerical examples. Zener diode and its applications (Voltage reference and voltage regulator). Realization of simple logic gates like AND OR gates.

##### Chapter 3: Transistor:

BJT, transistor voltages and currents, Signal amplifier (Fixed bias, Collector base bias, Voltage divider bias, CE configuration). DC load line. Voltage, current and power gains. Transistor as a switch: NOT Gate, Basic (DTL) NAND gate. Transistor as a Small Signal Amplifier (Single Stage and Two Stage RC-coupled Amplifiers).

#### Unit II

##### Chapter 4: Digital Logic:

Number systems: Decimal, Binary, Octal and Hexadecimal number systems, Conversions, Binary Operations- Addition and subtraction in binary number systems. Logic gates: Realization of simple logic functions using basic gates (AND, OR, NOT), Realization using universal gates (NAND, NOR). Boolean algebra: Theorems and postulates, DeMorgan's Theorems, simplification of logical expressions, Karnaugh Maps, Use of Karnaugh Maps to Minimize Boolean Expressions (2 Variables, 3 Variables and 4 Variables), Design of Half Adder and Full Adder, Parallel Adder using full adders.

##### Chapter 5: Operational Amplifier:

OPAMP characteristics (ideal and practical), Linear and non-linear applications: Inverting amplifier, Non inverting amplifier, Voltage follower, Integration, Differentiation, Adder, Subtractor, ZCD and Comparator.

#### Unit III

##### Chapter 6: Communication Systems:

Basic block diagram of communication system, types of modulation. Amplitude modulation: Time-Domain description, Frequency-Domain description. Generation of AM wave: square law modulator. Detection of AM waves: envelope detector. Double side band suppressed carrier modulation (DSBSC), Generation of DSBSC wave: balanced modulator, Super heterodyne principle.

##### Chapter 7: Linear Power Supply, UPS & CRO:

Working principle of linear power supply, UPS and CRO. Measurement of amplitude, frequency and phase of a

given signal.

**Text Books**

1. David A Bell, Electronic devices and Circuits, PHI New Delhi, 2004
2. K. A Krishnamurthy and M.R. Raghuvver, Electrical, Electronics and Computer Engineering for SISAntist and Engineers, 2, New Age International Publishers, 2001
3. A.P. Malvino, Electronic Principles, Tata McGraw Hill, 1999

**Reference Books:**

1. George Kennedy, Electronic Communication Systems, Tata McGraw Hill, 2000
2. Morris Mano, Digital logic and Computer design, 21st Indian print Prentice Hall India, 2000
3. Floyd, Digital fundamentals, 3, Prentice Hall India, 2001
4. Boylestead Nashelsky, Electronic devices & Circuit theory, Prentice Hall India, 2000
5. Ramakant Gaikawad, Operational Amplifiers & applications, PHI, 2000

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|-------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: II</b>              |
| <b>Course Title: Basic Mechanical Engineering</b>           |                                    | <b>Course Code: 22EECF101</b>    |
| <b>L-T-P: 0-0-3</b>                                         | <b>Credits: 3</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 50</b>                                        | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                | <b>Examination Duration: 3 Hrs</b> |                                  |

### Unit I

#### Chapter 1: Introduction to Mechanical Engineering:

Definition of engineering, Mechanical Engineering, Branches of Mechanical Engineering, who are Mechanical Engineers? Mechanical Engineers' top ten achievements. Visit to Workshop and Machine Shop, Tools, Safety Precautions Video presentations

#### Chapter 2: Manufacturing Engineering: Basics of Manufacturing

What is manufacturing? The main manufacturing sectors, The importance of the main manufacturing sectors to the Indian economy, Scales of production Classification of manufacturing Processes. Advances in Manufacturing: CNC machines, Mechatronics and applications Demonstration on working of Lathe, milling, drilling, grinding machines Demonstration on Welding (Electric Arc Welding, Gas Welding, Soldering) Demonstration and Exercises on Sheet metal work.

Visit to Learning Factory

### Unit II

#### Chapter 3: Design Engineering: Power Transmission Elements

Overview

Design Application:

- Belt Drives. Types, Length of Belt. Velocity Ratio, Initial Tension. Ratio of Tensions. Power Transmitted, Numerical Problems.
- Gears. Spur Gear, Rack and Pinion, Worm Gear, Bevel Gear, Helical Gears. Speed, Torque, and Power in Gear pair. Simple and Compound Gear trains. Numerical Problems.
- Ball and Roller Bearings, Types, Applications.

Design Problems like [a moving experience](#), aluminium can crusher Video presentations

#### Chapter 4: Thermal Engineering 1: Prime Movers.

Internal Combustion Engines: Classification, IC engine parts, 2 stroke SI and CI engine, 4 Stroke SI and CI Engine, PV diagrams of Otto and Diesel cycles, Comparison of 2 stroke and 4 stroke engine, comparison of CI and SI engine, Problems on Engine Performance, Future trends in IC engines. Case study on power requirement of a bike, car or any machine Video presentations.

### Unit III

#### Chapter 5: Thermal Engineering 2: Thermal Systems' Applications

Refrigeration system, Air conditioning system, Pumps, Blowers and Compressors, Turbines, and their working principle and specifications.

Case study on selection of various thermal systems

Video presentations

### Text Books

1. Jonathan Wickert and Kemper Lewis, An Introduction to Mechanical Engineering, Third Edition, 2013- Cengage Learning.
2. K.R. Gopalkrishna, Sudhir Gopalkrishna, S.C. Sharma. A Text Book of Elements of Mechanical Engineering, 30th Edition, Oct 2010,–Subhash Publishers, Bangalore.

### Reference Books:

1. Course Material developed by the Department of Mechanical Engineering.
2. SKH Chowdhary, AKH Chowdhary, Nirjhar Roy, The Elements of Workshop Technology - Vol I & II, 11th edition 2001, Media Promoters and Publishers.  
  
Basic Manufacturing, Roger Timings, Third edition, Newnes, An imprint of Elsevier

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|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b>                                                                         |                                    | <b>Semester: II</b>              |
| <b>Course Title: Professional Communication</b>                                                                                     |                                    | <b>Course Code: 15EHS101</b>     |
| <b>L-T-P: 1-1-0</b>                                                                                                                 | <b>Credits: 2</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 42Hrs</b>                                                                                                        | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>List of Experiments</b>                                                                                                          |                                    |                                  |
| <b>Chapter No. 1. Basics- English Communication</b>                                                                                 |                                    |                                  |
| Course Introduction, Explanation of template mix-ups with correct usages & necessity of grammar in error detection, Usage of tenses |                                    |                                  |
| <b>Chapter No. 2. Vocabulary and grammar</b>                                                                                        |                                    |                                  |
| Vocabulary, Word Formation and Active and Passive Voice                                                                             |                                    |                                  |
| <b>Chapter No. 3. Bouncing Practice</b>                                                                                             |                                    |                                  |
| Definition and types of bouncing and its practice with examples, reading skills, free style speech. Individual presentation.        |                                    |                                  |
| <b>Chapter No. 4. Rephrasing and Structures</b>                                                                                     |                                    |                                  |
| Comprehension and Rephrasing, PNQ Paradigm and Structural practice.                                                                 |                                    |                                  |
| <b>Chapter No. 5. Dialogues</b>                                                                                                     |                                    |                                  |
| Introduction of dialogues, Situational Role plays.                                                                                  |                                    |                                  |
| <b>Chapter No. 6. Business Communication</b>                                                                                        |                                    |                                  |
| Covering letter, formal letters, Construction of paragraphs on any given general topic.                                             |                                    |                                  |
| <b>Reference Books:</b>                                                                                                             |                                    |                                  |
| 1. Collins Cobuild Advanced Learner's English Dictionary                                                                            |                                    |                                  |
| 2. Raymond Murphy - Intermediate English Grammar, Cambridge University Press                                                        |                                    |                                  |
| 3. Martin Hewings- Advanced English Grammar, Cambridge University Press.                                                            |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                   | <b>Semester: III Semester</b>    |
| <b>Course Title: Integral transforms and Statistics</b>                               |                                   | <b>Course Code:15EMAB203</b>     |
| <b>L-T-P: 4-0-0</b>                                                                   | <b>Credits: 4</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                          | <b>Examination Duration:3 Hrs</b> |                                  |

### Unit I

#### Chapter 1. Laplace Transforms

Definition, transforms of elementary functions- transforms of derivatives and integrals- Properties. Periodic functions, Unit step functions and Unit impulse functions.

Inverse Transforms- properties- Convolution Theorem. Initial and Final value theorems, examples; Applications to differential equations, Circuit equations

#### Chapter 2: Probability

Definition of probability, conditional probability, Baye's rule, Chebyshev's inequality, random variables- PDF- CDF- Probability Distributions: Binomial, Poisson, Exponential, Uniform, and Normal.

### Unit II

#### Chapter 3: Regression

Introduction to method of least squares, fitting of curves= $a+bx$ ,  $y = ab^x$ , correlation and regression. Engineering problems.

#### Chapter 4: Fourier Series

Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Co-efficient of Exponential Fourier Series and Examples. Convergence of Fourier Series. Amplitude and phase spectra of a periodic signal. Properties of Fourier Series (with proof): Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties.

#### Chapter 6: Fourier Transform

Fourier representation of non-periodic signals, Magnitude and phase spectra. Properties of Fourier Transform: Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties.

### Unit III

#### Chapter 6: Random Process:

Introduction to Joint Probability Distributions, marginal distribution, joint pdf and cdf, mean, variance, covariance, correlation.

Introduction to Random process, stationary process, mean, correlation and covariance function, autocorrelation function, cross correlation, Power spectral Density: properties of the spectral density; Gaussian Process: Properties of Gaussian process.

**Text Books**

1. Kreyszig E., Advanced Engineering Mathematics, 10th edition, Wiley, 2015
2. Gupta S C and Kapoor V K, Fundamentals of Mathematical Statistics, 11<sup>th</sup> edition, Sultan Chand & Sons, 2018
3. Walpole and Myers, Probability and Statistics for Engineers and Scientists, 9<sup>th</sup> edition, Pearson Education India, 2013.

**Reference Books:**

1. Simon Haykin, Barry Van Veen, Signals and Systems Wiley; Second edition ,2007
2. J. Susan Milton, Jesse C. Arnold, Introduction to Probability and Statistics: Principles and
3. Applications for Engineering and the Computing Sciences, 4<sup>th</sup> edition, TATA McGraw-Hill Edition, 2017
4. Ian Glover & Peter Grant, Digital Communications, 3<sup>rd</sup> edition, Pearson 2009.

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                           |                                    | <b>Semester: III</b>             |
| <b>Course Title: Corporate Communication</b>                                                                                                                                                                                                                                                                          |                                    | <b>Course Code: 22EHS201</b>     |
| <b>L-T-P: 0-0-0</b>                                                                                                                                                                                                                                                                                                   | <b>Credits: 0.5</b>                | <b>Contact Hours: 1 hrs/week</b> |
| <b>ISA Marks: 100</b>                                                                                                                                                                                                                                                                                                 | <b>ESA Marks: --</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 16Hrs</b>                                                                                                                                                                                                                                                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Communication Skills</b><br>Tools of Communication, Listening, Body Language, Common Postures and Gestures, Open and Closed Body Language, Body Language to be used in Corporate Scenarios, Voice: Pitch, Pace, and Pause, Verbal Language: Positive & Negative Vocabulary, Corporate Conversations |                                    |                                  |
| <b>Chapter No. 2. Presentation Skills</b><br>Zero Presentation, Individual Presentations, and feedback, Making Presentations Interactive, Types of Questions, Taking off and Signing off differently, Captivating your Audience, Corporate Presentations                                                              |                                    |                                  |
| <b>Chapter No. 3. Spoken English</b><br>Phonetic and Non-Phonetic Languages, Introduction to IPA, Sounds in English, Syllables, Word Stress, Rhythm, Pausing, and Intonation                                                                                                                                          |                                    |                                  |
| <b>Chapter No. 4. Written English</b><br>Vocabulary Enhancement Strategies, Root Words in English, Grammar Improvement Techniques, Dictionary Usage, Similar and Contradictory Words                                                                                                                                  |                                    |                                  |
| <b>Reference Books:</b><br><br>1. Diana Booher - Communicate with Confidence, Mc Graw Hill Publishers<br>2. Norman Lewis – Word Power Made Easy, Goyal Publishers<br>3. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.                                                                          |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    | <b>Semester: III Semester</b>    |
| <b>Course Title: Circuit Analysis</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    | <b>Course Code: 22EECC201</b>    |
| <b>L-T-P: 4-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Credits: 4</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter 1: Basics</b><br>Active and passive circuit elements, Voltage & current sources, Resistive networks, Nodal Analysis, Super node, Mesh Analysis, Super mesh, Star – Delta Transformation.<br>[Text 1: Chapter 4,5, 7]<br><b>Chapter 2: Network Theorems</b><br>Homogeneity, Superposition and Linearity, Thevenin's & Norton's Theorems, Maximum Power Transfer Theorem, Miller's theorem, Reciprocity principle.<br>[Text 1: Chapter 5]<br><b>Chapter 3: Network topologies</b><br>Graph of a network, Concept of tree and co-tree, incidence matrix, tie set and cut set schedules, Formulation of Equilibrium equations in matrix form, Solution of resistive networks.<br>[Text 1: Chapter 5]                                                                                                                                                                                                                                            |                                    |                                  |
| <b>Unit II</b><br><b>Chapter 4: Two Port Networks</b><br>Two port variables, Z, Y, H, G, A- Parameter representations, Input and output impedance calculation, Series, Parallel and Cascade network connections, and their (suitable) models.<br>[Text 2: Chapter 11]<br><b>Chapter 5: Time and Frequency Domain Representation of Circuits</b><br>Order of a system, Concept of Time constant, System Governing equation, System Characteristic equation, Initial conditions, Transfer Functions (Fourier and Laplace domain representation)<br>[Text 2: Chapter 4]<br><b>Chapter 6: First order circuits</b><br>Transient response of R-C and R-L networks (with Initial conditions) Concept of phasor, Phasor diagrams, Frequency response characteristics, Polar Plots-C, R-L circuits as differentiator and integrator models, time and frequency domain responses R-C, R-L circuits as Low pass and high pass filters [Text 2: Chapter 5, Text 1: Chapter 8,9,10] |                                    |                                  |
| <b>Unit III</b><br><b>Chapter No. 7. Higher order circuits</b><br>Higher order R-C, R-L, and R-L-C networks, time domain and frequency domain representation, Series R-L-C circuit, Transient response, damping factor, Performance parameters, Quality factor, Frequency response curve, peaking of frequency curve and its relation to damping factor. Series and Parallel Resonance, Quality factor, Selectivity and Bandwidth<br>[Text 2: Chapter 7,8] [Text 1: Chapter 4,5, 7]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |

**Text Books**

1. W H Hayt, J E Kemmerly, S M Durban, "Engineering Circuit Analysis" McGraw Hill Education; Eighth edition ,2013
2. M E. Van Valkenburg, Network Analysis, Third edition Pearson Education, 2019

**Reference Books:**

1. Joseph Edminister, Mahmood Nahavi, Electric Circuits, 5th edition, McGraw Hill Education, 2017
2. V. K. Aatre, —Network Theory and Filter Design,<sup>3rd</sup> edition, New Age International Private Limited,2014

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|---------------------------------------------------------------------------------------|-----------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                   | <b>Semester: III Semester</b>    |
| <b>Course Title: Analog Electronic Circuits</b>                                       |                                   | <b>Course Code:22EECC202</b>     |
| <b>L-T-P: 4-0-0</b>                                                                   | <b>Credits: 4</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                          | <b>Examination Duration:3 Hrs</b> |                                  |

## Unit I

### Chapter 1: Diode Models and Circuits

Recap of diode models: Exponential model, piece-wise linear model, constant voltage drop model, ideal diode model, small signal diode model and derivation of small signal diode resistance. Applications of diodes as a Clipping and clamping circuits with and without DC bias voltage; Voltage doublers Numericals on applications. (T1: 2.2, 2.3.1 to 2.3.8, 2.6.1to 2.6.3.)

### Chapter 2: Bipolar junction transistors

Recap of DC load line and bias point, small signal operation-the transfer characteristics, the amplifier gain, and operation as a switch. Biasing of BJT: voltage divider, small signal models of bipolar transistors, two port modelling of amplifiers, H-model, ac analysis of BJT circuits-coupling and bypass capacitor, Common emitter circuit analysis without RE resistance (Emitter resistor) Numericals on amplifiers and switch (T1: 3.2.1,3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.3.2, 3.3.4)

### Chapter 3: MOSFETs structure and physical operation

MOSFET Device structure, NMOS :Depletion type ; operation with no gate voltage, positive and negative gate voltage and Enhancement type ; operation with no gate voltage, positive and negative gate voltage creating a channel for current flow, applying small  $v_{ds}$ , operation as  $v_{ds}$  is increased, Derivation of threshold voltage of MOSFET, Operating the MOS transistor in the sub threshold region, Pinch off effect , channel length modulation effect , derivation of the  $I_D$ - $V_{DS}$  relationship, with and without channel length modulation. Finite output resistance ( $r_{ds\ on}$ ) in saturation, PMOS: Drain and Transfer characteristics, circuit symbol, the  $I_D$   $v/s$   $V_{DS}$  characteristics, and the role of the substrate-the body effect, temperature effects, breakdown and input protection. Threshold Voltage Derivation MOSFET circuits at DC.

## Unit II

### Chapter 4: Biasing of MOSFETs

MOSFET circuits at DC continued. Biasing in MOS amplifier circuits: By fixing  $V_{GS}$ ; By fixing  $V_G$ ; With drain to gate feedback resistor; Constant current source biasing, MOSFET as a switch Large – signal operation, operation as a linear amplifier and Numericals. (T1:4.3)

### Chapter 5: MOSFET amplifiers

Small signal operation and models, single stage MOS amplifiers, the MOSFET internal capacitance, Derivation of CS, CG and CD amplifiers parameters and its comparison, Implications on gain and Bandwidth. Source degenerated common source amplifier, cascode and cascaded circuits High frequency model of the MOSFET, revision of common-gate, common- source, common-drain circuits; poles and zeros in the transfer function (T1:4.4,4.5, 4.6.1 to 4.6.7, 4.7.1, 4.7.2, 4.7.3, 4.7.5, 4.7.6, 4.7.7;4.8.1,4.8.2, 4.8.3,4.8.4, 4.9.1 to 4.9.3)

**Unit III****Chapter 6: Feedback Amplifiers**

General feedback structure (Block schematic), Feedback desensitivity factor, positive and negative feedback Nyquist stability Criterion, RC phase shift oscillator, Wein bridge Oscillator, merits of negative feedback, feedback topologies: series-shunt feedback amplifier, series-series feedback amplifier, and shunt-shunt and shunt-series feedback amplifier with examples

(T1:7.1 to 7.6)

**Chapter 7: Large Signal Amplifiers**

Classification of amplifiers: (A, B, AB and C); Transformer coupled amplifier, push-pull amplifier Transistor case and heat sink.

(T1:12.1 to 12.6;12.8.4)

**Text Books**

1. A.S. Sedra & K.C. Smith, "Microelectronic Circuits", 7<sup>th</sup> edition, Oxford University Press, 2017

**Reference Books:**

1. Jacob Millman and Christos Halkias-Integrated Electronics "McGraw Hill Education, 2<sup>nd</sup> edition 2017
2. David A. Bell, -Electronic Devices and Circuits, Oxford Fifth edition 2008
3. Grey, Hurst, Lewis and Meyer, -Analysis and design of analog integrated circuits, Wiley, 5<sup>th</sup> edition 2009
4. Thomas L. Floyd, -Electronic devices, Pearson, 10<sup>th</sup> edition, 2018
5. Richard R. Spencer & Mohammed S. Ghousi, — Introduction to Electronic Circuit Design, Pearson Education, 2003
6. J. Millman & A. Grabel, "Microelectronics"-2<sup>nd</sup> edition, McGraw Hill, 2017
7. Behzad Razavi, -Fundamentals of Microelectronics, 2<sup>nd</sup> edition Wiley; 2013

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    | <b>Semester: III Semester</b>    |
| <b>Course Title: Digital Circuits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    | <b>Course Code: 19EECC201</b>    |
| <b>L-T-P: 4-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits: 4</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter 1: Logic Families</b><br>Logic levels, output switching times, fan-in and fan-out, comparison of logic families<br><b>Chapter 2: Principles of Combinational Logic</b><br>Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4 variables, incompletely specified functions (Don't care terms), Simplifying Maxterm equations, Quine-McCluskey minimization technique- Quine-McCluskey using don't care terms, Reduced Prime Implicant Tables.<br><b>Chapter 3: Analysis and design of combinational logic</b><br>General approach, Decoders-BCD decoders, Encoders, Digital multiplexers- Using multiplexers as Boolean function generators. Adders and subtractor-Cascading full adders, look ahead carry adders, Binary comparators. |                                    |                                  |
| <b>Unit II</b><br><b>Chapter 4: Introduction to Sequential Circuits</b><br>Basic Bistable Element, Latches, A SR Latch, Application of SR Latch, A Switch De-bouncer, The SR Latch, the gated SR Latch, the gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop; Characteristic Equations<br><b>Chapter 5: Analysis of Sequential Circuits</b><br>Registers and Counters, Binary Ripple Counters, Synchronous Binary counters, Ring and Johnson Counters, Design of a Synchronous counters, Design of a Synchronous Mod-n Counter using clocked JK Flip-Flops Design of a Synchronous Mod-n Counter using clocked D, T or SR Flip-Flops.      |                                    |                                  |
| <b>Unit III</b><br><b>Chapter No. 6. Sequential Circuit Design</b><br>Introduction to Sequential Circuit Design, Mealy and Moore Models, State Machine notations, Synchronous Sequential Circuit Analysis, Construction of state Diagrams and counter design.<br><b>Chapter No. 7. Introduction to memories</b><br>Introduction and role of memory in a computer system, memory types and terminology, Read Only memory, MROM, PROM, EPROM, EEPROM, Random access memory, SRAM, DRAM, NVRAM.                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. Donald D Givone, Digital Principles and Design, McGraw Hill Education, 2017</li> <li>2. John M Yarbrough, Digital Logic Applications and Design, 1<sup>st</sup> edition Cengage Learning, 2006</li> <li>3. A AnandKumar, Fundamentals of digital circuits 4th Revised edition, PHI, 2016</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Charles H Roth, Fundamentals of Logic Design, 7<sup>th</sup> edition, Cengage Learning, 2015</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |



2. ZviKohavi, Switching and Finite Automata Theory Cambridge University Press;  
3 edition October 2009
3. R.D. Sudhaker Samuel, Logic Design, Pearson Education ,2010
4. R P Jain, Modern Digital Electronics ,4th edition, McGraw Hill Education,2009

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   | <b>Semester: III Semester</b>    |
| <b>Course Title: Signals and Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   | <b>Course Code:19EECC202</b>     |
| <b>L-T-P: 4-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Credits: 4</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Examination Duration:3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                  |
| <p><b>Chapter 1: Signal Representation:</b> Definition of a signals and systems, classification of signals, (analog and discrete signal, periodic and aperiodic, deterministic and random signals, even and odd signals, energy and power), basic operation on signals (independent variable, dependent variable, time scaling, multiplication, time reversal), elementary signals (Impulse, step, ramp, sinusoidal, complex exponential), Systems Interconnections (series, parallel and cascade), properties of linear systems. (homogeneity, superposition, linearity and time invariance, stability, memory, causality)</p> <p><b>Chapter2: LTI System Representation:</b> Impulse response representation and properties, Convolution, convolution sum and convolution integral. Differential and difference equation Representation, Block diagram representation.</p> |                                   |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |                                  |
| <p><b>Chapter 3: Fourier representation for signals:</b> Introduction, Discrete time Fourier series (derivation of series excluded) and their properties. Discrete Fourier transform (derivation of transform excluded) and properties Introduction, frequency response of LTI systems, Fourier transform representation of periodic signals</p> <p><b>Chapter 4: Applications of Fourier transform,</b> Fourier transform representation of discrete time signals. Sampling of continuous time signals.</p>                                                                                                                                                                                                                                                                                                                                                                 |                                   |                                  |
| <b>Unit III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |                                  |
| <p><b>Chapter No. 05: Z-transform:</b> Definition of z-transform, Properties of ROC, Properties of Z-transforms: Inverse z-transforms (Partial Fraction method, long division method), Unilateral Z-transform, Transform of LTI.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |                                  |
| <b>Text Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   |                                  |
| <ol style="list-style-type: none"> <li>1. Simon Haykin and Barry Van Veen, Signals and Systems, 2<sup>nd</sup> edition Wiley,2007</li> <li>2. Alan V Oppenheim, Alan S Willsky and S. Hamid Nawab, Signals and Systems, Second, PHI public,1997</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |                                  |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |                                  |
| <ol style="list-style-type: none"> <li>1. H. P Hsu, R. Ranjan, Signals and Systems, 2<sup>nd</sup> edition, McGraw Hill ,2017</li> <li>2. Ganesh Rao and SatishTunga, SignalsandSystems1st edition, Cengage India, 2017</li> <li>3. M.J.Roberts, Fundamentals of Signals and Systems 2nd edition, McGraw Hill Education, 2017</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   |                                  |

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              | <b>Semester: III Semester</b>   |
| <b>Course Title: Digital Circuits Lab</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                              | <b>Course Code:22EECP201</b>    |
| <b>L-T-P: 0-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits: 1</b>            | <b>Contact Hours: 2Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>ESA Marks: 20</b>         | <b>Total Marks: 100</b>         |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Examination Duration:</b> |                                 |
| <b>List of Experiments:</b> <ol style="list-style-type: none"><li>1. Characterization of TTL Gates– Propagation delay, Fan-in, Fan-out and Noise Margin.</li><li>2. To verify of Flipflops (a) JK Master Slave (b) T-type and (c)D-Type</li><li>3. Design and implement binary to gray, gray to binary, BCD to Ex-3 and Ex-3 to BCD code converters.</li><li>4. Design and implement BCD adder and Subtractor using 4 bitparalleladder.</li><li>5. Design and implement n bit magnitude comparator using 4- bit comparators.</li><li>6. Design and implement Ring and Johnson counter using shift register.</li><li>7. Design and implement 8:3 Priority Encoder</li><li>8. Design and implement frequency divider</li><li>9. Design and implement mod-6 synchronous and asynchronous counters using flip flops.</li><li>10. Design and implement given functionality using decoders and multiplexers.</li><li>11. Design and implement a digital system to display a 3-bit counter on a 7-segment display.<br/>Demonstrate the results on a general purposePCB.</li></ol> <p><b>**Note-All above experiments are to be conducted along with simulation.</b></p> <p><b>*Digital Circuits Lab: Simulation of combinational and sequential circuits using netlist based Spice Simulators (Avoid using drag n drop), before implementing the circuits on breadboard</b></p> |                              |                                 |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. K.A. Krishnamurthy-Digital lab primer  , Pearson Education Asia Publications, 2003.</li><li>2. A.P. Malvino, -Electronic Principles 7<sup>th</sup> edition, McGraw Hill Education,2017</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                              |                                 |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                              | <b>Semester: III Semester</b>  |
| <b>Course Title: Analog Electronic Circuits Lab</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              | <b>Course Code:22EECP202</b>   |
| <b>L-T-P: 0-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Credits: 1</b>            | <b>Contact Hours:2Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>ESA Marks: 20</b>         | <b>Total Marks: 100</b>        |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Examination Duration:</b> |                                |
| <b>List of Experiments:</b> <ol style="list-style-type: none"> <li>1. Study of multi-meters, power supplies, function generators, Oscilloscopes; Identification of various components and devices, e.g. resistors, capacitors, diodes, transistors.</li> <li>2. Design &amp; analyze Diode Clipping circuits.</li> <li>3. Design &amp; analyze Positive and Negative Clamping circuits.</li> <li>4. Study of BJT as a Switch.</li> <li>5. Study the input and output characteristics of MOSFET.</li> <li>6. To study the basic current mirror circuit.</li> <li>7. MOSFET as a source follower (Buffer).</li> <li>8. Study of transformer-less Class B push pull power amplifier and determination of its conversion efficiency</li> <li>9. Design an amplifier using BJT and determine its gain, input, output impedance and frequency response of RC Coupled single stage BJT amplifier</li> <li>10. Design an amplifier using MOSFET and determine its gain, input, output impedance and frequency response of a CS amplifier.</li> <li>11. Design a regulated power supply for the given specifications</li> </ol> <p><b>**Note: All above experiments are to be conducted along with simulation. *Analog Electronic Circuits Lab: Simulation of designed circuits using LTSpice Simulator, before implementing the circuits on breadboard.</b></p> |                              |                                |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. "Integrated Electronics", by Jacob Millman and Christos Halkias, McGraw Hill,</li> <li>2. "Microelectronic Circuits", by A.S. Sedra &amp; K.C. Smith, 7th Edition, Oxford Univ. Press, 2017.</li> <li>3. "Electronic Devices and Circuits" by David A. Bell, 4th edition, PHI publication 2007.</li> <li>4. "Analysis and design of analog integrated circuits," by Grey, Hurst, Lewis and Meyer, 4th edition. Device data sheets.</li> <li>5. KLETECH Electronics and Communication Engineering Department 2023-24 Analog Electronics Lab manual.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                              |                                |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  | <b>Semester: III Semester</b>    |
| <b>Course Title: Microcontroller Architecture &amp; Programming</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  | <b>Course Code: 22EECF202</b>    |
| <b>L-T-P: 2-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits: 3</b>                | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>ESA Marks: 20</b>             | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Examination Duration: Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter 1: Microprocessors and microcontroller</b><br>Introduction, Microprocessors and Microcontrollers, A Microcontroller Survey, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture.<br><b>Chapter 2: The 8051 Architecture</b><br>8051 Microcontroller Hardware, Input / Output Pins, Ports and Circuits, semiconductor Memories, Interfacing external RAM & ROM memories.<br><b>Chapter 3: Addressing Modes and Arithmetic Operations</b><br>Addressing modes, External data Moves, Code Memory, Read Only Data Moves / Indexed Addressing mode, Data exchanges, stack concept and related instructions, example programs. Logical Operations: Introduction, Byte level, logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs, Arithmetic Operations: Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction Multiplication and Division, Decimal Arithmetic, Example Programs. |                                  |                                  |
| <b>Unit II</b><br><b>Chapter 4: Branch operations</b><br>Jump Operations: Introduction, The JUMP and CALL Program range, Jump calls and Subroutines Interrupts and Returns, Example Problems.<br><b>Chapter 5: 8051 Programming in 'C'</b><br>Data Types and Time delays in 8051C, I/O Programming, Logic operations, Data Conversion programs, Accessing code ROM space, Data serialization.<br><b>Chapter 6: Counter/Timer Programming in 8051</b><br>Programming 8051 Timers, Programming Timer0 and Timer1 in 8051C                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |                                  |
| <b>Unit III</b><br><b>Chapter 7: Serial Communication</b><br>Basics of Serial Communication, 8051 connections to RS-232, 8051 Serial Communication modes, Programming, Serial port programming in C.<br><b>Chapter 8: 8051 interfacing and applications</b><br>Interfacing 8051 to LCD, Keyboard, ADC, DAC, Stepper Motor, DC Motor.<br><b>Chapter 9: Interrupts</b><br>Introduction to interrupts, interrupts vs polling, classification of interrupts, interrupt priority, interrupt vector table, interrupt service routine                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. "The 8051 Microcontroller Architecture, Programming &amp; Applications" by ' Kenneth J. Ayala', Penram International, 1996</li> <li>2. "The 8051 Microcontroller and Embedded systems", by ' Muhammad Ali Mazidi and Janice Gillispie Mazidi', Pearson Education, 2003</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                  |



**Reference Books:**

1. "Programming and Customizing the 8051 Microcontroller ", by 'Predko', TMH.

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                              | <b>Semester: III Semester</b>    |
| <b>Course Title: C Programming for Problem Solving (Diploma)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              | <b>Course Code: 24EECF205</b>    |
| <b>L-T-P: 0-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Credits: 2</b>            | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>ESA Marks: 20</b>         | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 52Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Examination Duration:</b> |                                  |
| <b>Introduction to Problem solving</b><br>Introduction to algorithms/flowcharts and its notations, to pdown design, elementary problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                              |                                  |
| <b>Basics of C programming language</b><br>Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data types, Input and Output statements.                                                                                                                                                                                                                                                                                                                                                                                                                  |                              |                                  |
| <b>Decision control statements</b><br>Conditional branching statements: if statement, if else statement, else if-ladder, switch statement, unconditional branching statements: break, continue. Introduction to Debugging Skills. Introduction to Test Driven Programming.                                                                                                                                                                                                                                                                                                                                                    |                              |                                  |
| <b>Iterative statements</b><br>While, do-while, for, Nested statements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                              |                                  |
| <b>Functions</b><br>Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, Introduction to macros and Coding Standards.                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                                  |
| <b>Arrays and Strings</b><br>Introduction, Declaration, accessing elements, Storing values in arrays, Operations on one-dimensional array, Operations on two-dimensional arrays.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                                  |
| <b>Pointers</b><br>Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to function using pointers, pointers and arrays, Passing an array to a function.                                                                                                                                                                                                                                                                                                                                                                                                                  |                              |                                  |
| <b>Structures and Unions</b><br>Introduction, passing structures to functions, Array of structures, Unions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                              |                                  |
| <b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Elliot B. Koffman, Jeri R. Hanly Problem Solving and Program Design in C, 8<sup>th</sup> ed, PHI, 2016</li> <li>2. Yashvant Kanetkar, Let us C, 17<sup>th</sup> ed, BPS Publication, 2018.</li> </ol> <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. BW Kernighan, DM Ritchie, The Programming language C, 2<sup>nd</sup> ed, PHI, 2015.</li> <li>2. R.G. Dromey, How to Solve it by Computer, 1<sup>st</sup> ed, PHI, 2008.</li> <li>3. BS Gottfried, Programming with C (Schaum's Outlines Series), 4<sup>th</sup> ed, TMH, 2018</li> </ol> |                              |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   | <b>Semester: IV Semester</b>     |
| <b>Course Title: Linear Algebra and Partial Differential Equations</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                   | <b>Course Code:15EMAB208</b>     |
| <b>L-T-P: 4-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Credits: 4</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Examination Duration:3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter1: Partial differential equations</b><br>Introduction, classification of PDE, Formation of PDE, Solution of equation of the type $Pp + Qq = R$ , Solution of partial differential equation by direct integration methods, method of separation of variables. Modeling: Vibration of string-wave equation, heat equation. Laplace equation. Solution by method of separation of variables.<br><b>Chapter2: Finite difference method</b><br>Finite difference approximations to derivatives, finite difference solution of parabolic PDE, explicit and implicit methods; Hyperbolic PDE-explicit method, Elliptic PDE-initial-boundary Value problems.                                                                                                                                                                                                                                                                                                                                   |                                   |                                  |
| <b>Unit II</b><br><b>Chapter 3: Fourier Series</b><br>Complex Sinusoids, Fourier series representations of four classes of signals, Periodic Signals: Fourier Series representations, Derivation of Complex Co-efficient of Exponential Fourier Series and Examples. Convergence of Fourier Series. Amplitude and phase spectra of a periodic signal. Properties of Fourier Series (with proof): Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval 's theorem and Examples on these properties.<br><b>Chapter 4: Fourier Transform</b><br>Fourier representation of non-periodic signals, Magnitude and phase spectra. Properties of Fourier Transform: Linearity, Symmetry Properties, Time shift, Frequency Shift, Scaling, Time differential differentiation coefficients, Time domain Convolution, Multiplication Theorem, Parseval's theorem and Examples on these properties. |                                   |                                  |
| <b>Unit III</b><br><b>Chapter5: Complex analysis</b><br>Function of complex variables. Limits, continuity and differentiability. Analytic functions, C-R equations in Cartesian and polar forms, construction of Analytic functions (Cartesian and polar forms).<br><b>Chapter 6: Complex Integration</b><br>Line integral, Cauchy's theorem- corollaries, Cauchy's integral formula. Taylor's and Laurent Series, Singularities, Poles, Residue theorem – problems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. Simon Haykin, Barry Van Veen, Signals and Systems, 2<sup>nd</sup> edition, Wiley, 2007</li> <li>2. Peter V. O'neil, Advanced Engineering Mathematics Cengage Learning Custom Publishing; 7th Revised edition 2011</li> <li>3. Dennis Gzill and Michael R Cullin, " Advanced Engineering Mathematics", 4<sup>th</sup> edition, Narosa Publishing House, NewDelhi, 2012</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Kreyszig E., Advanced Engineering Mathematics, 10th edition, Wiley, 2015</li> <li>2. Stanley J Farlow, Partial differential equations for Scientists and Engineers, Dover publications, INC, New York, 1993</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                   |                                  |



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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    | <b>Semester: IV</b>              |
| <b>Course Title: Problem Solving &amp; Analysis</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    | <b>Course Code: 22EHS202</b>     |
| <b>L-T-P: 0-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Credits: 0</b>                  | <b>Contact Hours: 1 hrs/week</b> |
| <b>ISA Marks: 100</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>ESA Marks: --</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 16Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Analytical Thinking</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                  |
| Analysis of Problems, Puzzles for practice, Human Relations, Direction Tests; Looking for Patterns: Number and Alphabet Series, Coding Decoding; Diagrammatic Solving: Sets and Venn diagram-based puzzles; Visual Reasoning, Clocks and Calendars                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>Chapter No. 2. Mathematical Thinking</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| Number System, Factors and Multiples, Using Simple Equations for Problem Solving, Ratio, Proportion, and Variation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>Chapter No. 3. Verbal Ability:</b> Problem Solving using Analogies, Sentence Completion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |
| <b>Chapter No. 4. Discussions &amp; Debates</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                  |
| Team efforts in Problem Solving; A Zero Group Discussion, Mock Group Discussions, and Feedback; Discussion v/s Debate; Starting a Group Discussion: Recruitment and other Corporate Scenarios; Evaluation Parameters in a Recruitment Group Discussion, Types of Initiators: Verbal and Thought, Conclusion of a Discussion                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| <ol style="list-style-type: none"> <li>1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018</li> <li>2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018</li> <li>3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India</li> <li>4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018</li> <li>5. Diana Booher - Communicate with Confidence, Mc Graw Hill Publishers</li> <li>6. Norman Lewis—Word Power Made Easy, Goyal Publishers</li> <li>7. Cambridge Advanced Learner's Dictionary, Cambridge University Press.</li> <li>8. Kaplan's GRE guide</li> </ol> |                                    |                                  |

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|---------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: IV Semester</b>     |
| <b>Course Title: Electromagnetic Fields and Waves</b>                                 |                                    | <b>Course Code: 23EECC209</b>    |
| <b>L-T-P: 3-0-0</b>                                                                   | <b>Credits: 3</b>                  | <b>Contact Hours: 3 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |

## Unit I

### Chapter 1: Electrostatic Fields

Introduction, Coulomb's Law and Field Intensity, Electric Fields Due to Continuous Charge Distribution, Electric Flux Density, Gauss's Law – Maxwell's Equation, Application of Gauss's Law, Electric Potential, Relationship between E and V – Maxwell's Equation, An Electric Dipole and Flux Lines, Energy Density in Electrostatic Fields.

### Chapter 2: Electric Fields in Material Space

Introduction, Properties of materials, Convection and Conduction Currents, Conductors, Polarization in Dielectrics, Dielectric Constant and strength, Continuity Equation and Relaxation Time, Boundary Conditions.

### Chapter 3: Electrostatic Boundary-Value Problems

Introduction, Poisson's and Laplace's Equations, Uniqueness Theorem, General Procedure for Solving Poisson's or Laplace's Equation, Resistance and Capacitance, Method of Images.

## Unit II

### Chapter 4: Magnetostatic Fields

Introduction, Biot-Savart's Law, Ampere's Circuit Law—Maxwell's Equation, Applications of Ampere's Law, Magnetic Flux Density—Maxwell's Equation, Maxwell's Equations for Static EM Fields, Magnetic Scalar and Vector Potentials, Derivation of Biot-Savart's Law and Ampere's Law.

### Chapter 5: Magnetic Forces, Materials and Devices

Introduction, Forces due to Magnetic Fields, Magnetic Torque and Moment, A Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits, Force on Magnetic Materials

### Chapter 6: Maxwell's Equations

Introduction, Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields.

## Unit III

### Chapter 7: Electromagnetic Wave Propagation

Introduction, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Reflection of a Plane Wave at Oblique Incidence.

## Text Books

1. Mathew N. O. Sadiku, Elements of Electromagnetics, 4th Edition, Oxford University Press, 2007
2. William Hayt, Jr. John A. Buck, Engineering Electromagnetics, 8th edition, TMH, 2012
3. Kraus, John D. Electromagnetics. United Kingdom, McGraw-Hill, 1992.

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   | <b>Semester: IV Semester</b>     |
| <b>Course Title: Linear Integrated Circuits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   | <b>Course Code:19EECC203</b>     |
| <b>L-T-P: 4-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Credits: 4</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Examination Duration:3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter No 1. Basic Op-Amp architecture</b><br>Basic differential amplifier, Common mode and difference mode gain, CMRR, 5-pack differential amplifier and 7-pack operational amplifier.<br><b>Chapter No 2. Op-Amp characteristics</b><br>Ideal and non-ideal Op-Amp terminal characteristics, Input and output impedance, output Offset voltage, Small signal and Large signal bandwidth<br><b>Chapter No 3. Op-Amp with Feedback</b><br>Op-Amp under Positive and Negative feedback, Impact of Negative feedback on Bandwidth, Input and Output impedances, Offset voltage under negative feedback, Follower property & Inversion Property under linear mode operation, Direct coupled voltage followers, non-inverting amplifiers, inverting amplifiers |                                   |                                  |
| <b>Unit II</b><br><b>Chapter No 4. Linear applications of Op-Amp</b><br>DC and AC Amplifier, Summing, Scaling and Averaging amplifiers (Inverting, Non-inverting and Differential configuration), Instrumentation Amplifier, Integrator, Differentiator, Voltage sources, current sources and current sinks, Active Filters –First and second order Low pass & High pass filters. V to I and I to V converters.<br><b>Chapter No 5. Nonlinear applications of Op-Amp</b><br>Zero Crossing detectors (ZCD. Comparator), Inverting and Non-inverting Schmitt trigger circuits, Triangular/rectangular wave generators, Waveform generator, Voltage controlled Oscillator.                                                                                                         |                                   |                                  |
| <b>Unit III</b><br><b>Chapter No 6. Oscillator: Sample and hold circuits, Phase shift oscillator, Wein bridge oscillator, PLL</b><br><b>Chapter No 7. Data Converters: Digital to Analog Converters: Weighted resistor; R -2R, Current steering DAC, Pipeline. Analog to Digital Converters: Flash, Dual slope, Pipeline and SAR.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. Behzad Razavi, Design of Analog CMOS Integrated Circuits McGraw-Hill, 2nd edition, 2016</li> <li>2. Phillip E. Allen, Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press, USA, 2010</li> <li>3. Ramakant A. Gayakwad, Op - Amps and Linear Integrated Circuits, 4th Edition</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. A.S. Sedra &amp; K.C. Smith, Microelectronic Circuits, 7th Edition, 2017</li> <li>2. Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, 4th edition, Tata McGraw Hill 2014</li> <li>3. David A. Bell, Operational Amplifiers and Linear IC's, 3rd ed., Oxford University Press, 2011</li> <li>4. B. Razavi, Fundamentals of Microelectronics, 2nd edition.</li> </ol>                                                                                                                                                                                                                                                                                                          |                                   |                                  |



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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: IV Semester</b>     |
| <b>Course Title: Control Systems</b>                                                  |                                    | <b>Course Code: 23EECC206</b>    |
| <b>L-T-P: 4-0-0</b>                                                                   | <b>Credits: 4</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |

#### Unit I

##### Chapter No. 1. Control System Representation

Concepts of Control Systems- Open Loop and Closed Loop Control Systems, Feedback characteristics, Examples, System representation: Differential Equations, Transfer function, Impulse response, System Modeling: Electrical Mechanical, Rotational Mechanical Systems.

##### Chapter No. 2. Block Diagram and Signal Flow Graphs

Transfer Functions, Block Diagram Algebra and Representation by Signal Flow Graph - Reduction Using Mason's Gain Formula.

##### Chapter No. 3. Time Response Analysis

Standard Test Signals (impulse, step, ramp, parabola)-Order and Type of System, Time Response of First Order Systems – Characteristic Equation of Feedback Control Systems, Transient Response of Second Order Systems - Time Domain Specifications – Steady State Response - Steady State Errors and Error Constants – Effects of Proportional Derivative, Proportional Integral Systems

#### Unit II

##### Chapter No. 4. Stability Analysis in S-Domain

The Concept of Stability (BIBO, all system poles on LHS, Impulse response is convergent, Marginal stability-necessary conditions) – Routh's Stability Criterion – Limitations of Routh's Stability Criterion (Applications only). Root Locus Technique: The Root Locus Concept - Construction of Root Loci.

##### Chapter No. 5. Frequency Response Analysis

Introduction, Bode Diagrams-Determination Of Frequency Domain Specifications And Transfer Function From The Bode Diagram-Phase Margin And Gain Margin-Stability Analysis From Bode Plots.

#### Unit III

##### Chapter No. 6. Stability Analysis In Frequency Domain

Polar Plots, Nyquist Plots Stability Analysis, Assessment Of Relative Stability Using Nyquist Criterion

##### Chapter No. 7. Introduction to Controller Design

The Design Problem. Preliminary Consideration Of Classical Design, Realization Of Basic Compensators (Lag, Lead and dominant pole compensation), P, I, PI, PD & PID Controllers.

#### Text Books

1. J. Nagrath and M. Gopal, Control Systems Engineering; Sixth edition, New Age International Pvt Ltd 2018
2. B. C. Kuo, Automatic Control Systems, 9<sup>th</sup> edition, John Wiley and Sons, 2014

#### Reference Books:

1. Katsuhiko Ogata, Modern Control Engineering, 5<sup>th</sup> edition, Pearson education India Pvt. Ltd, 2015,
2. Richard C Dorf and Robert H. Bishop, Modern Control Systems, 13<sup>th</sup> edition, Pearson; 2016

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> | <b>Semester: IV Semester</b> |
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| <b>Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |                                  |
| <b>Course Title: ARM Processor &amp; Applications</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   | <b>Course Code:22EECC207</b>     |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Credits: 3</b>                 | <b>Contact Hours: 3 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Examination Duration:3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter No. 1 ARM Architecture</b><br>The Acorn RISC machine, Architectural inheritance, Architecture of ARM7TDMI, ARM programmers model, ARM development tools, 3 stage pipeline ARM organization, ARM instruction execution.<br><b>Chapter No. 2 Introduction to ARM instruction set</b><br>Data processing instruction, Branch instruction, Load store instruction, Software interrupt instruction, Program status register instruction, Conditional execution, Example programs, introduction to thumb instruction and implementation.<br><b>Chapter No. 3 Assembler rules and Directives</b><br>Introduction, structure of assembly language modules, Predefined register names, frequently used directives, Macros, Miscellaneous assembler features. Example programs. |                                   |                                  |
| <b>Unit II</b><br><b>Chapter No. 4 Exception handling</b><br>Introduction, Interrupts, error conditions, processor exception sequence, the vector table, Exception handlers, Exception priorities, Procedures for handling exceptions.<br><b>Chapter No. 5 Introduction to Bus protocols:</b><br>I2C, SPI, AMBA (advanced memory bus architecture): AHB, APB<br><b>Chapter No. 6 LPC 2148 Controller Architectural overview and GPIO programming</b><br>LPC2148 architectural overview, Registers, GPIO Programming: LED, LCD, Seven segment, Stepper Motor, DC Motor, Buzzer, Switch, Keypad.                                                                                                                                                                                                    |                                   |                                  |
| <b>Unit III</b><br><b>Chapter No. 7 On-chip programming techniques using LPC 2148 Controller</b><br>ARM interfacing techniques and programming: Timers, RTC, UART, ADC, DAC, I2C and External Interrupt.<br><b>Chapter No. 8 Architectural support for high level languages</b><br>Abstraction in software design, data types, floating point data types, The ARM floating point architecture, use of memory, run time environment.                                                                                                                                                                                                                                                                                                                                                               |                                   |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. The 8051 Microcontroller Architecture, Programming &amp; Applications " By Kenneth J. Ayala, Cenage Learning; 3<sup>rd</sup> edition 2007</li> <li>2. ARM System- On-Chip Architecture by 'Steve Furber', Second Edition, Pearson,2015</li> <li>3. ARM Assembly Language fundamentals and Techniques by William Hohl, CRC press CRC Press; 2<sup>nd</sup> edition,2014</li> </ol>                                                                                                                                                                                                                                                                                                                                                     |                                   |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. ARM system Developer 's Guide- Hard bound, Publication date:2004 Imprint: MORGAN KAUFFMAN</li> <li>2. User manual onLPC21XX.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |                                  |
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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   | <b>Semester: IV Semester</b>     |
| <b>Course Title: Digital System Design using Verilog</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   | <b>Course Code:22EECC208</b>     |
| <b>L-T-P: 0-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Credits: 2</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>ESA Marks: 20</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Examination Duration:2 Hrs</b> |                                  |
| <p><b>1. Chapter No. 1. Architecture of FPGA</b><br/>Architecture of FPGAs: Spartan 6, What Is HDL, Verilog HDL Data Types and Operators.</p> <p><b>2. Chapter No. 2. Data Flow Descriptions</b><br/>Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type - Vectors, Testbench.</p> <p><b>3. Chapter No. 3. Behavioural Descriptions</b><br/>Behavioural Description highlights, structure of HDL behavioural Description, The VHDL variable –Assignment Statement, sequential statements, Tasks and Functions</p> <p><b>4. Chapter No. 4. Structural Descriptions</b><br/>Highlights of structural Description, Organization of the structural Descriptions, state Machines, Generate, Generic, and Parameter statements</p> <p><b>5. Chapter No. 5. Finite State Machine:</b><br/>Moore Machines, Mealy Machines</p> <p><b>6. Chapter No. 6. Interfacing and applications</b><br/>LCD, 7 Segment display, Keyboard, Traffic light controller, Stepper Motor, DC Motor.</p> |                                   |                                  |
| <p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. Nazeih M. Botros, HDL Programming –Verilog, Dreamtech Press,2006.</li> <li>2. J.Bhaskar, “AVerilog Primer”,; 3rd edition, Pearson Education India ,2015</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                                  |
| <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Samir Palnitkar, –Verilog HDL, Pearson Education,2<sup>nd</sup> Edition,2003.</li> <li>2. Thomas and Moorby, –The Verilog Hardware Description Language, Kluwer academic publishers,5<sup>th</sup> edition, 2002.</li> <li>3. Stephen Brown and Zvonko , Vranesic, –Fundamentals of Logic Design with Verilog; 2<sup>nd</sup>edition, McGraw Hill Education 2017.</li> <li>4. Charles. H. Roth, Jr.,Lizy Kurian John–Digital System Design using VHDL, Thomson, 2ndEdition,2008.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   | <b>Semester: IV Semester</b>    |
| <b>Course Title: Data Acquisition and Control Lab</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   | <b>Course Code:22EECP203</b>    |
| <b>L-T-P: 0-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Credits: 1</b>                 | <b>Contact Hours:2 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>ESA Marks: 20</b>              | <b>Total Marks: 100</b>         |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Examination Duration:2 Hrs</b> |                                 |
| <b>List of Experiments:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                                 |
| <ol style="list-style-type: none"><li>1. Basic Signal Conditioning Techniques<ol style="list-style-type: none"><li>a) Inverting and Non-Inverting Amplifier using OPAMP.</li><li>b) Comparator. (ZCD &amp;Schmitttrigger)</li><li>c) Precision rectifier</li></ol></li><li>2. Realize and verify the performance of Instrumentation Amplifier usingop-amp</li><li>3. Feedback Concepts: Realize and verify the performance of WeinBridge Oscillator usingop-amp</li><li>4. To design and implement the filters for a givenspecification<br/>Obtain the phase and frequency responses of 2nd order, Low pass and High pass filter.</li><li>5. To implement and characterize the functional block of ADC and DAC.<br/><br/>Realize the following data converters to determine their respective performance parameters.<ul style="list-style-type: none"><li>• 4-bit R-2R D-A Converter.</li><li>• 2-Bit flash ADC/4-Bit ADC (Using0804IC</li></ul></li><li>6. System Modeling<ul style="list-style-type: none"><li>• Realize the system modeling for DC Motor using Quanser Qube</li></ul></li><li>7. To determine System Response of RLC circuits<br/><br/>Time domain response of an RLC network and the response parameters of interest (Rise time, Peak overshoot, Overshoot and Settling time) for critical, over and under damped conditions using Labview.<br/><br/>Time response using Quanser Qube</li><li>8. Stability Analysis To determine the stability of the system depending upon Pole - Zero location. To determine the stability of the system using Bode Plots.</li><li>9. Compensation Techniques To determine suitable compensator for the given system (PD, PI, PID Controller using Quanser Qube).</li><li>10. Structured Enquiry (16+16=32marks)<ul style="list-style-type: none"><li>• MOS Amplifier Design and implementation</li><li>• Design and implement a PD control system using Co-simulation.</li></ul></li></ol> |                                   |                                 |
| <b>Text Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                 |
| <ol style="list-style-type: none"><li>1. Ramakant Gayakwad, Operational Amplifiers and Linear Integrated Circuits; Fourth edition</li></ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |                                 |

Pearson Education, 2015

2. Sergio Franco Design with Op-amps and Analog Integrated circuits, MHE; third edition, 2012

**Reference Books:**

1. Dan Sheingold Analog to Digital Conversion Hand Book, 3rd Revised edition PH, 1986. Prentice Hall, 1985
2. David A. Bell, Operational Amplifiers and Linear ICs.; Third edition, Oxford University Press, 2011
3. Sedra and Smith — Microelectronics Circuits, Sixth edition, Oxford University, 2013

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|---------------------------------------------------------------------------------------|-----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                   | <b>Semester: IV Semester</b>    |
| <b>Course Title: ARM Microcontroller Lab</b>                                          |                                   | <b>Course Code:22EECP204</b>    |
| <b>L-T-P:0-0-1</b>                                                                    | <b>Credits: 1</b>                 | <b>Contact Hours:2 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                  | <b>ESA Marks: 20</b>              | <b>Total Marks: 100</b>         |
| <b>Teaching Hours: --</b>                                                             | <b>Examination Duration:2 Hrs</b> |                                 |

**List of Experiments:**

1. Write an ALP to achieve the following arithmetic operations:

- i) 32-bit addition
- ii) 64-bit addition
- iii) Subtraction
- iv) Multiplication
- v) 32-bit binary divide

Apply suitable machine dependent optimization technique and analyze for memory at time consumed

2. Write an ALP for the following using loops:

- i) Find the sum of 'N' 16 bit numbers
- ii) Find the maximum/minimum of N numbers
- iii) Find the factorial of a given number with and without look up table.

Apply suitable machine dependent optimization technique and analyze for memory and time consumed

3. Write an ALP to

- i) Find the length of the carriage return terminated string.
- ii) Compare two strings for equality.

Apply suitable machine dependent optimization technique and analyze for memory and time consumed

4. Write an ALP to pass parameters to a subroutine to find the factorial of a number or prime number generation.

Apply suitable machine dependent optimization technique and analyze for memory and time consumed

5. Write a C program to test working of LEDs and seven segment using LPC2148.

6. Write a C program & demonstrate an interfacing of Alphanumeric LCD 2X16 panel and 4X4 keypad to LPC2148 Microcontroller.

7. Write an ALP to generate the following waveforms of different frequencies

- i) Square wave
- ii) Triangular
- iii) Sine wave

8. Write a program that converts the data read from sensor to a data understandable for the ARM microcontroller.

9. Develop a C program to demonstrate the concept of serial communication with an example.
10. Develop an application code using embedded C to accept asynchronous inputs and control the connected device
11. Develop an application code using synchronous communication protocol to display the RTC value on a display device

**Text Books**

1. Steve Furber, ARM System- On-Chip Architecture, 2nd, LPE, 2002
2. The 8051 Microcontroller Architecture, Programming & Applications" By \_Kenneth J. Ayala, Cengage Learning; 3<sup>rd</sup> edition 2007
3. William Hohl ARM Assembly Language fundamentals and Techniques by, CRC press CRC Press; 2<sup>nd</sup> edition ,2014

**Reference Books:**

1. -ARM system Developer 's Guide- Hardbound, Publication date:2004 Imprint: MORGAN KAUFFMAN
2. User manual on LPC21XX.

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   | <b>Semester: IV Semester</b>     |
| <b>Course Title: Data Structures Application Laboratory</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   | <b>Course Code:21EECF201</b>     |
| <b>L-T-P: 0-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Credits: 2</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>ESA Marks: 20</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Examination Duration:2 Hrs</b> |                                  |
| <p><b>Chapter No 1. Analysis of algorithms:</b> Introduction, Asymptotic notations and analysis, Analysis of recursive and non-recursive algorithms, master's theorem, complexity analysis of algorithms.</p> <p><b>Chapter No 2. Analysis of linear data-structures and its applications:</b> Complexity analysis of basic data structures (Stacks, Queues, Linked lists)</p>                                                                                                                                          |                                   |                                  |
| <p><b>Chapter No 3. Analysis of non-linear data-structures and its applications</b><br/>Trees and applications: Computer representation, Tree properties, Binary Tree properties, Binary search trees properties and implementation, Tree traversals, AVL tree.<br/>Graphs and applications: Computer representation, Adjacency List, Adjacency Matrix, Graph properties, Graph traversals.<br/>Hashing and applications: Hashing, Hash function, Hash Table, Collision resolution techniques, Hashing Applications</p> |                                   |                                  |
| <p><b>Text Books</b></p> <ol style="list-style-type: none"><li>1. Richard F. Gilberg &amp; Behrouz A. Forouzan, Data Structures A Pseudocode Approach with C, Second Edition.</li><li>2. Aaron M. Tenenbaum, Data Structures Using C</li></ol>                                                                                                                                                                                                                                                                          |                                   |                                  |

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|---------------------------------------------------------------------------------------|-----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                   | <b>Semester: IV Semester</b>    |
| <b>Course Title: Problem Solving with Data Structures</b>                             |                                   | <b>Course Code:24EECF206</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits: 3</b>                 | <b>Contact Hours:6 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                  | <b>ESA Marks: 20</b>              | <b>Total Marks: 100</b>         |
| <b>Teaching Hours:</b>                                                                | <b>Examination Duration:2 Hrs</b> |                                 |

#### **Chapter No. 1: Introduction to Data Structures**

Review of C: Structures and pointers, Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Dynamic Memory Allocation Functions, Files – File manipulation programs

#### **Chapter No.2: Lists**

Concept of lists: Abstract data type, Definition, Representation of linked lists in Memory, Operations: Traversing, Searching, Insertion and Deletion., Doubly Linked lists, Circular linked lists Applications of Linked lists – Polynomials, Sparse matrix representation and other applications

#### **Chapter No. 3: Stacks and Recursion**

Stack: Definition, Operations, Stack ADT Implementation of stack operations. Polish notation: Infix to postfix conversion, evaluation of postfix expression, parenthesis matching and other applications.

Recursion: Factorial of a number, GCD of two numbers, Ackerman's problem, Fibonacci series.

#### **Chapter No. 4: Queues**

Queue: Definitions, Queue ADT, Variants of Queues: Linear queue, circular queue, priority queue, double ended queue and multiple queues. Applications of queue: Simulation of queuing systems and other applications.

#### **Chapter No. 5: Binary trees**

Binary Tree: Definition, Terminology and representation, Tree Traversals both recursive and Iterative. Binary Search Tree and its applications

#### **Text Books:**

1. Data Structures Using C and C++ - Y. Langsam, M. Augenstein And A. M. Tenenbaum, Prentice - Hall of India Pvt. Ltd. Edition- 2, 2006
2. Data Structures with C -- Seymour Lipschutz, Tata McGraw Hill India LTD, Edition-1, 2011

#### **References:**

1. Data Structures and Algorithms Made Easy – Narshiman Karumunchi, Career Monk Publications, Edition-2, 2017.
2. Data Structure Through C - Yashavant P Kanetkar, BPB Publication, Edition-3
3. Problem Solving in Data structures and Algorithms Using C – Hemant Jain, Taran Technologies Private Limited, Edition-1, 2016
4. Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. The MIT Press, Edition-3, 2009.
5. Cracking the coding interview-Gayle McDowell, Edition-6
6. Online platform: [www.Hackerrank.com](http://www.Hackerrank.com) , [www.geeksforgeeks.com](http://www.geeksforgeeks.com)

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: V Semester</b>      |
| <b>Course Title: CMOS VLSI Circuits</b>                                               |                                    | <b>Course Code: 24EECC301</b>    |
| <b>L-T-P: 4-0-0</b>                                                                   | <b>Credits: 4</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |

## Unit I

### Chapter No. 1. Electronic Analysis of CMOS logic gates

DC transfer characteristics of CMOS inverter, Beta Ratio Effects, Noise Margin, MOS capacitance models. Transient Analysis of CMOS Inverter, NAND, NOR and Complex Logic Gates, Gate Design for Transient Performance, Switch-level RC Delay Models, Delay Estimation, Elmore Delay Model, Power Dissipation of CMOS Inverter, Transmission Gates & Pass Transistors, Tristate Inverter.

### Chapter No. 2. Design of CMOS logic gates

Stick Diagrams, Euler Path, Semiconductor Technology - An Overview, Czochralski method of growing Silicon, Introduction to Unit Processes (Oxidation, Diffusion, Deposition, Ion-implantation), Layout design rules, DRC, Circuit extraction, Layout of AOI and OAI circuits, latch up – Triggering Prevention.

## Unit II

### Chapter No. 3. Designing Combinational Logic Networks

Gate Delays, Driving Large Capacitive Loads, Delay Minimization in an Inverter Cascade, Logical effort. Pseudo nMOS, Clocked CMOS, Dynamic CMOS Logic Circuits, Dual-rail Logic Networks: CVSL, CPL.

### Chapter No. 4. Standard Cell Layout

Digital Standard cell library development, Schematic (beta calculations, stage ratio) layout (architecture, height of cell, power rail calculations), RC extraction, abstract, and LEF file characterization.

## Unit III

### Chapter No. 5. Sequential CMOS Circuit Design

Sequencing static circuits, Circuit design of latches and flip-flops, Clocking- clock generation, clock distribution.

### Chapter No. 6. Static Timing Analysis

Timing Paths, Time Borrowing, Basic Concepts of Setup and Hold time, Basic Concepts of Setup and Hold time violation, Practical examples for Setup and Hold time/violation

## Text Books

1. John P. Uyemura, Introduction to VLSI Circuits and Systems, 1, Wiley, 2007
2. Neil Weste, David Harris & Ayan Banerjee, CMOS VLSI Design, 3, Pearson Ed, 2005
3. J. Bhasker and Rakesh Chadha, "Static Timing Analysis for Nanometre Designs A Practical Approach" Springer 2009
4. Keith Barr - ASIC Design in the Silicon Sandbox- A Complete Guide to Building Mixed-Signal Integrated Circuits-McGraw-Hill Professional (2006)



**Reference Books:**

1. Wayne, Wolf, Modern VLSI design: System on Silicon, 3, Pearson Ed, 2005
2. Douglas A Pucknell and Kamran Eshraghian, Basic VLSI Design, 3, PHI, 2005
3. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3, Tata McGraw, 2007

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|---------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: V Semester</b>      |
| <b>Course Title: Communication Systems</b>                                            |                                    | <b>Course Code: 25EECC302</b>    |
| <b>L-T-P: 3-0-0</b>                                                                   | <b>Credits: 4</b>                  | <b>Contact Hours: 3 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |

#### Unit I

**Chapter 01. Introduction to Analog communication:** Introduction, history of communication, need for modulation, Amplitude modulation, Time-Domain and Frequency domain description, Frequency-Domain description, DSBSC, SSB, VSB, Phase and frequency modulation, Phase and frequency Deviation, Narrow and Wide band frequency modulation. Spectrum and phase diagram of FM Transmission band width of FM waves, Effect of Modulation index on bandwidth, Comparison of all modulation techniques.

#### Chapter 02. Sampling Process:

Sampling theorem, Quadrature sampling of Band pass signals, Reconstruction of a message from its samples. Time Division Multiplexing (TDM) Signal distortion in Sampling. Pulse Amplitude Modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM)

#### Unit II

#### Chapter 03. Waveform Coding Techniques:

Pulse-Code Modulation, Channel noise and Error Probability, Quantization noise and Signal to noise ratio, Robust Quantization, Differential Pulse code modulation, Delta Modulation, Problems

#### Chapter 04. Baseband shaping for data transmission:

Discrete PAM signals, Power spectra of discrete PAM signals, Intersymbol Interference, Nyquist's criterion for distortion less baseband binary transmission, correlative coding, eye pattern, baseband M-ary PAM systems, and adaptive equalization for data transmission,

#### Unit III

#### Chapter 05. Digital Modulation Techniques:

Digital Modulation formats, Coherent binary modulation techniques, Coherent quadrature modulation techniques, Non-coherent binary modulation techniques, Comparison of Binary and Quaternary Modulation techniques, Problems

#### Text Books:

1. "Communication Systems" by 'Simon Haykin' John Wiley 2003. 5th edition, 2009
2. "Principles of communication Systems", by Taub & Schilling, 2nd edition, TMH.
3. "Digital communications", Simon Haykin, John Wiley, 2006

#### Reference Books:

1. Communication Systems, by B.P. Lathi,
2. Ganesh Rao, K N Haribhat, Analog Communication, Sanguine, 2009
3. Communication Systems by Harold. P.E, Stern Samy. A. Mahmond, Pearson Education, 2004.
4. Electronic communication systems, Kennedy and Davis, TMH, Edn. 6, 2012

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                          |                                    | <b>Semester: V Semester</b>      |
| <b>Course Title: Digital Signal Processing</b>                                                                                                                                                                                                                                                                                 |                                    | <b>Course Code: 25EECC303</b>    |
| <b>L-T-P: 2-0-2</b>                                                                                                                                                                                                                                                                                                            | <b>Credits: 4</b>                  | <b>Contact Hours: 6 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                           | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                                                                                                                                                   | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Discrete Fourier Transforms</b><br>Brief review of signals and systems: Basic definitions, properties and applications. Discrete Fourier Transforms (DFT), DFT as a linear transformation, Properties of DFT, Use of DFT in linear filtering, Overlap-save and Overlap-add method.                         |                                    |                                  |
| <b>Unit II</b><br><b>Fast-Fourier-Transform (FFT) algorithms</b><br>Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, Need for efficient computation of the DFT (i.e. FFT algorithms), Radix-2 FFT algorithm for the computation of DFT and IDFT: Decimation-in-time and Decimation-in-frequency algorithms. |                                    |                                  |
| <b>Unit III</b><br><b>Design of digital IIR and FIR filters</b><br>Design of IIR filters: Butterworth and Chebyshev methods using impulse invariance technique, and bilinear transformation.<br>Design of linear phase FIR filters using windowing method - Rectangular, Hamming, Hanning, Bartlet and Kaiser windows.         |                                    |                                  |
| <b>Text Books:</b> <ol style="list-style-type: none"><li>1. Proakis &amp; Manolakis, Digital signal processing Principles Algorithms &amp; Applications, 4th edition, PHI, New Delhi, 2007</li><li>2. S.K. Mitra, Digital Signal Processing, 2nd edition, Tata Mc-Graw Hill, 2004</li></ol>                                    |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. Oppenheim &amp; Schaffer, Discrete Time Signal Processing, 5th edition, PHI, New Delhi, 2000</li></ol>                                                                                                                                                        |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    | <b>Semester: V Semester</b>      |
| <b>Course Title: Operating System and Embedded System Design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    | <b>Course Code: 25EECC304</b>    |
| <b>L-T-P: 3-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Credits: 3</b>                  | <b>Contact Hours: 5 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter No 1. Introduction to Operating System:</b> What is an operating system? Goals of an operating system. Operation of an OS. Operating System Services. System Calls and Types. Operating system Structure – Simple, Monolithic and Microkernels, System Boot<br><b>Chapter No 2. Process Management:</b> Process concept- operating on the process, inter-process communication, process scheduling- CPU scheduler-preemptive scheduling, scheduling criteria, scheduling algorithms- first come, first served scheduling, shortest job first scheduling, priority scheduling, round robin scheduling<br><b>Chapter No 3. Introduction: to Real-Time Operating Systems:</b> Introduction to Real-Time Operating Systems, Introduction to the real-time embedded system and types. Key characteristics of RTOS, its kernel, components in RTOS kernel, and Scheduling types: Preemptive priority-based scheduling, Round-robin and preemptive scheduling |                                    |                                  |
| <b>Unit II</b><br><b>Chapter No 4. Tasks, Task Synchronization and Programming:</b> Task: Structure, Semaphore: Structure, Types: binary semaphore, mutual exclusion (mutex) semaphore, and uses. Event Flags: Structure, uses, and program using RTX kernel. Priority Inversion problem and its solutions.<br><b>Chapter No 5. Intertask Communication and Programming:</b> Message Queue: Structure, state diagram, operation, Uses and program using RTX kernel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| <b>Unit III</b><br><b>Chapter No 6 Embedded System Design Concepts and Firmware Development:</b> Classification and purposes of embedded system, Characteristics of embedded system, Operational and non-operational quality attributes of embedded system. Core and Supporting components of embedded system. Embedded firmware development.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                  |
| <b>Text Books</b> <ol style="list-style-type: none"> <li>1. Silberschatz, Galvin and Gagne, Operating system concepts, 9th edition, WILEY Publication, 2018.</li> <li>2. Qing Li with Caroline Yao, Real-Time Concepts for Embedded Systems, 1E, Published, 2011</li> <li>3. Shibu K V, Introduction to Embedded systems, 2<sup>nd</sup> edition, McGraw Hill Education India Private Limited, 2017</li> <li>4. Raj Kamal, Embedded Systems, Paperback, 3<sup>rd</sup> edition, McGraw-Hill Education, 2017</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |
| <b>Reference Books:</b> 1. Dhananjay Dhamdhere, Operating Systems a Concept Based Approach, 3 <sup>rd</sup> edition, McGraw-Hill Education, 2017                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                  |

### Experiment Wise Plan

**List of experiments/jobs planned to meet the requirements of the course.**

| <b>Category: Exercise</b> |                                                                                                                                                            |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exp No</b>             | <b>Experiment / Job Details</b>                                                                                                                            |
| 1                         | Write an optimized C program to Create Tasks using RTX Kernel. Also, comment on the performance.                                                           |
| 2                         | Write an optimized RTOS program & demonstrate the concept of Round Robin Task Scheduling, and comment on performance.                                      |
| 3                         | Write an optimized RTOS program to demonstrate the concept of a basic preemptive scheduling algorithm using RTX Kernel and comment on performance.         |
| 4                         | Write an optimized RTOS program & demonstrate the concept of Events and Flags for inter-task communication using RTX Kernel. Also, comment on performance. |
| 5                         | Write an optimized RTOS program & demonstrate the concept of Mailbox, and comment on performance.                                                          |
| 6                         | Write an optimized RTOS program & demonstrate the concept of Semaphore, and comment on performance.                                                        |

| <b>Category: Open Ended</b> |                                                                                                                                                             |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Expt./ Job No.</b>       | <b>Experiment / Job Details</b>                                                                                                                             |
| 1                           | Design and implement an application using a Real-Time Operating System (RTOS) to address the specific requirements outlined in the given problem statement. |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                   | <b>Semester: V</b>               |
| <b>Course Title: Machine Learning&amp; Deep Learning</b>                              |                                   | <b>Course Code: 24EECC309</b>    |
| <b>L-T-P: 2-0-2</b>                                                                   | <b>Credits: 4</b>                 | <b>Contact Hours: 6 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                          | <b>Examination Duration:3 Hrs</b> |                                  |

## Unit I

### Chapter No.1 Introduction

Motivation, History and Evolution, Definition (ETP, Examples), Types of Machine Learning: Supervised, Unsupervised and Reinforcement learning.

### Chapter No. 2 Supervised Learning

Model Representation: Basic Terminologies (Variable/features, Input, Output, Model, Learning Algorithm, Hypothesis, Cost/Loss function) Linear Regression: Single Variable (Representation of hypothesis, cost function, Optimization: Sum of squared error (L1 and L2), parameters/weights, bias) without bias and with bias. Model Optimization: Introducing Iterative optimization (Sum of squares error function, Gradient descent algorithm) and non-iterative optimization. Linear Regression: Polynomial Regression and Multi-variable Regression (Representation of hypothesis, cost function, Optimization).Model Optimization: Gradient descent algorithm (Learning rate/ step size, Normalization/ Feature Scaling).Model Optimization: Non-iterative optimization (Normal Equation).Logistic Regression: Hypothesis Representation, Decision boundary, Cost function, Logistic Regression: Optimization (Gradient Descent), Multi-class classification (One-vs.-all classification using logistic regression), Classical supervised learning algorithm- Support Vector Machine (SVM).

### Chapter No. 3 Performance Evaluation

Performance Evaluation of learning models: Metrics (Confusion matrix, Precision, Recall, F1 Score, RoC curves), Modeling data and validating learning, over fitting, Trade of Bias and Variance, Methods to overcome over fitting (Feature reduction, Regularization).

## Unit II

### Chapter No. 4 Unsupervised Learning

Clustering: Introduction, K-means Clustering, Algorithm, Cost function, Applications, Dimensionality Reduction: Motivation, Definition, Methods of Dimensionality reduction, Dimensionality Reduction: PCA-Principal Component Analysis.

### Chapter No. 5 Introduction to Neural Network and deep learning

Introduction to Neural Networks (Motivation: non-linear model, Neurons and perception), Model representation: Neural Network Architecture (Activation units, Layers), Neural Network: Initialization, Forwards propagation, and Cost function, Back propagation algorithm, Multi-class classification, Steps to train a neural network, Applications of Neural Networks, Introduction to Deep Learning (Motivation, Overview), Convolution Neural Networks (CNN) (Architecture, terminologies, Evolution and Modelling).

## Text Books

1. Tom Mitchell, Machine Learning, 1, McGraw-Hill, 1997
2. Christopher Bishop, Pattern Recognition and Machine Learning, 1, Springer, 2007

## Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining Inference and Prediction, 2, Springer, 2009

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                |                                    | <b>Semester: V</b>               |
| <b>Course Title: CMOS VLSI Circuits Lab</b>                                                                                                                                                                                                                                                                                                                                                          |                                    | <b>Course Code: 24EECP301</b>    |
| <b>L-T-P: 0-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>Credits: 1</b>                  | <b>Contact Hours: 2 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                                                                                                                                                                                                                                                                                                                                 | <b>ESA Marks: 20</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                            | <b>Examination Duration: 2 Hrs</b> |                                  |
| <b>List of Experiments:</b> <ol style="list-style-type: none"><li>1. Introduction to Cadence EDA tool.</li><li>2. Static and Dynamic Characteristic of CMOS inverter.</li><li>3. Layout of CMOS Inverter (DRC, LVS)</li><li>4. Static and Dynamic Characteristic of CMOS NAND2 and NOR2.</li><li>5. Layout of NAND2, NOR2, XOR2 gates (DRC, LVS).</li><li>6. Analysis of Transmission Gate</li></ol> |                                    |                                  |
| <b>Structured Enquiry</b> <ol style="list-style-type: none"><li>1. AOI and OAI analysis and layout</li><li>2. Design of D-FF</li></ol>                                                                                                                                                                                                                                                               |                                    |                                  |
| <b>Open Ended</b> <ol style="list-style-type: none"><li>1. Design complex combinational circuits and analyze the performance using Cadence tool.</li></ol>                                                                                                                                                                                                                                           |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. John P. Uyemura, -Introduction to VLSI Circuits and Systems, Wiley, 2006.</li><li>2. Neil Weste and K. Eshragian, Principles of CMOS VLSI Design: A System Perspective, 2nd edition, Pearson Education (Asia) Ptv. Ltd., 2000.</li></ol>                                                                                            |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: V</b>               |
| <b>Course Title: Mini Project</b>                                                     |                                    | <b>Course Code: 23EECW301</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits: 3</b>                  | <b>Contact Hours: 6 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 28Hrs</b>                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |

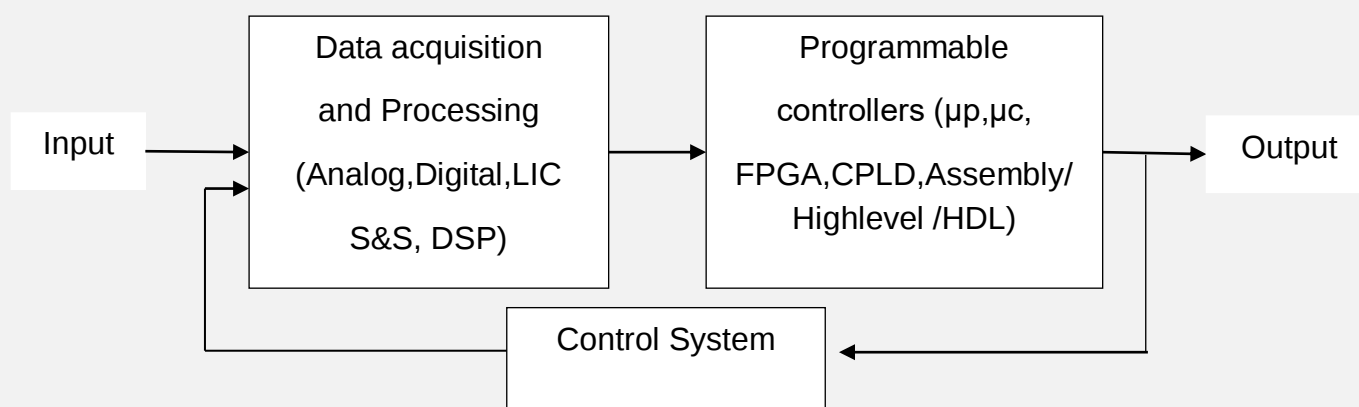
**Guide lines for selection of a project:**

The project needs to encompass the concepts learnt in a subject/s studied in the previous four semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the identified need.

Project should be able to exhibit sensing, controlling and actuation sections.

The mini project essentially will comprise of two components:

- The hardware design
- The graphical user interface (GUI) for application and data analysis with report generation.



Student can select a project which leads to a product or model or prototype related to following areas (not limited to these areas).

- Pulse and digital circuits: simulate the working of one or more circuits
- Signals and systems: simulate the behaviour of a system by considering different signals
- Analog Electronic: simulate working of different devices
- Control systems: simulate the behaviour of a control system
- Linear Integrated Circuits: simulate working of one or more circuits
- Micro-controllers: simulate the ALU/control unit of microcontroller

**Time plan:** Effort to do the project should be between 120-150 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).

**Learning overhead** should be 20-25% of total project development time.



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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    | <b>Semester: V</b>               |
| <b>Course Title: Arithmetical Thinking and Analytical Reasoning</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    | <b>Course Code: 23EHSA303</b>    |
| <b>L-T-P: 0-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Credits: 0</b>                  | <b>Contact Hours: 1 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 16Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Analytical Thinking</b><br>Importance of Sense of Analysis for Engineers, Corporate Methodology of Testing Sense of Analysis, Puzzles for practice: Analytical, Mathematical, Classification Puzzles, Teamwork in Problem Solving                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| <b>Chapter No. 2. Mathematical Thinking I</b><br>Problems on Finance: Percentages, Gain and Loss, Interest; Distribution and Efficiency Problems: Averages, Time Work, Permutations Combinations                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                  |
| <b>Chapter No. 3. Mathematical Thinking II</b><br>Distribution Problems: Permutations Combinations                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                  |
| <b>Chapter No. 4. Verbal Ability</b><br>Comprehension of Passages, Error Detection and Correction Exercises, Common Verbal Ability questions from Corporate Recruitment Tests                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. George J Summers, "The Great Book of Puzzles &amp; Teasers", Jaico Publishing House, 1989</li><li>2. Shakuntala Devi, "Puzzles to Puzzle You", Orient Paper Backs, New Delhi, 1976</li><li>3. R. S. Aggarwal, "A Modern Approach to Logical Reasoning", Sultan Chand and Sons, New Delhi, 2018</li><li>4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018</li><li>5. Cambridge Advanced Learner's Dictionary, Cambridge University Press.</li><li>6. Kaplan's GRE guide</li></ol> |                                    |                                  |

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|-----------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering</b>                                                                         |                                     |                                  |
| <b>Course Title: Communication Systems Lab</b>                                                                  |                                     | <b>Course Code:25EECP304</b>     |
| <b>L-T-P: 0-0-1</b>                                                                                             | <b>Credits: 1</b>                   | <b>Contact Hours:2 hrs./week</b> |
| <b>ISA Marks: 80</b>                                                                                            | <b>ESA Marks: 20</b>                | <b>Total Marks: 100</b>          |
| <b>Teaching Hours:</b>                                                                                          | <b>Examination Duration: 2 hrs.</b> |                                  |
| 1. Design and demonstration of the working of Flat top sampling for a given message signal.                     |                                     |                                  |
| 2. Amplitude Modulation and Demodulation                                                                        |                                     |                                  |
| 3. Frequency Modulation and Demodulation                                                                        |                                     |                                  |
| 4. Design and verify the operation of ASK generator and demodulator                                             |                                     |                                  |
| 5. Design and verify the operation of FSK generator and detector                                                |                                     |                                  |
| 6. Design and verify the operation PSK generator and detector.                                                  |                                     |                                  |
| 7. Design and demonstrate the working of Time Division Multiplexing and recovery of two bandlimited PAM signals |                                     |                                  |
| <b>Structured Enquiry:</b>                                                                                      |                                     |                                  |
| 8. Design and demonstration of Pulse Width modulation                                                           |                                     |                                  |
| <b>Open-ended</b>                                                                                               |                                     |                                  |
| 9. Design and Evaluation of a Signal Agnostic Spectrum Monitoring system for Dynamic Frequency Environments     |                                     |                                  |
| 10. Design and analysis of symbol timing synchronization for training – free baseband reception                 |                                     |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                            |                                    | <b>Semester: VI Semester</b>  |
| <b>Course Title: Professional Aptitude and Logical reasoning</b>                                                                                                                                                 |                                    | <b>Course Code: 23EHSA302</b> |
| <b>L-T-P: 0-0-0</b>                                                                                                                                                                                              | <b>Credits: Audit</b>              | <b>Contact Hours:</b>         |
| <b>ISA Marks: 50</b>                                                                                                                                                                                             | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>       |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                     | <b>Examination Duration: 3 Hrs</b> |                               |
| <b>Unit I</b><br>Chapter 1. – Arithmetical Reasoning<br>Chapter 2. – Analytical Thinking<br>Chapter 3. – Syllogistic Logic                                                                                       |                                    |                               |
| <b>Unit II</b><br>Chapter 1. – Verbal Logic<br>Chapter 2. – Non-Verbal Logic                                                                                                                                     |                                    |                               |
| <b>Unit III</b><br>Chapter 1. - Lateral Thinking                                                                                                                                                                 |                                    |                               |
| <b>Text Books</b><br>1. A Modern Approach to Verbal and Non – Verbal Reasoning – R. S. Aggarwal, Sultan Chand and Sons, New Delhi<br>2. Quantitative Aptitude – R. S. Aggarwal, Sultan Chand and Sons, New Delhi |                                    |                               |
| <b>Reference Books:</b><br>1. Verbal and Non – Verbal Reasoning – Dr. Ravi Chopra, MacMillan India<br>2. Lateral Thinking – Dr. Edward De Bono, Penguin Books, New Delhi                                         |                                    |                               |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                             |                                    | <b>Semester: VI</b>              |
| <b>Course Title: Industry Readiness &amp; Leadership Skills</b>                                                                                                                                                                                                                                                                                                                         |                                    | <b>Course Code: 23EHSA304</b>    |
| <b>L-T-P: 0-0-0</b>                                                                                                                                                                                                                                                                                                                                                                     | <b>Credits: 0</b>                  | <b>Contact Hours: 1 hrs/week</b> |
| <b>ISA Marks: 25</b>                                                                                                                                                                                                                                                                                                                                                                    | <b>ESA Marks: 75</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 16Hrs</b>                                                                                                                                                                                                                                                                                                                                                            | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Written Communication</b><br>Successful Job Applications, Résumé Writing, Emails, Letters, Business Communication, Essay, and Paragraph Writing for Recruitment Tests                                                                                                                                                                                                 |                                    |                                  |
| <b>Chapter No. 2. Interview Handling Skills</b><br>Understanding Interviewer Psychology, Common Questions in HR Interviews, Grooming, Interview Etiquette                                                                                                                                                                                                                               |                                    |                                  |
| <b>Chapter No. 3. Lateral &amp; Creative Thinking</b><br>Lateral Thinking by Edward de Bono, Fractionation and Brain Storming, Mind Maps, Creativity Enhancement through Activities                                                                                                                                                                                                     |                                    |                                  |
| <b>Chapter No. 4. Team Building &amp; Leadership Skills</b><br>Communication in a Team, Leadership Styles, Playing a Team member, Belbin's team roles, Ethics, Effective Leadership Strategies                                                                                                                                                                                          |                                    |                                  |
| <b>Reference Books:</b><br><br>1. Diana Booher – E Writing, Laxmi Publications<br>2. Edward de Bono–Lateral Thinking – A Textbook of Creativity, Penguin UK<br>3. William Strunk, E B White – The Elements of Style, Pearson<br>4. John Maxwell – The 17 Essential Qualities of a Team Player, HarperCollins Leadership<br>5. Robin Ryan – 60 Seconds and You're Hired! – Penguin Books |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: Automotive Electronics</b>                                           |                                    | <b>Course Code: 24EECC305</b>    |
| <b>L-T-P: 3-0-1</b>                                                                   | <b>Credits: 4</b>                  | <b>Contact Hours: 5 Hrs/week</b> |
| <b>ISA Marks: 63</b>                                                                  | <b>ESA Marks: 37</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |

#### Unit I

##### Chapter No: 1. Automotive fundamentals and electronics

Overview of automotive industry, vehicle functional domains, automotive mechanical systems, ECU design cycle: Model Based Design, V and Agile. Fundamentals of electric vehicle: Drive cycles, EV drive train, EV Batteries, Types of EV.

##### Chapter No: 2. Automotive Control Systems Design

Control strategies for automotive systems, automotive grade microcontrollers, and Engine management system: engine mapping, catalytic converter, electronic fuel and ignition control. Automotive Sensors and Actuators: Characteristics and Applications.

#### Unit II

##### Chapter No: 3. Vehicle safety and stability systems

Active and passive safety systems: ABS, Traction Control, ESP, Electronics suspension system, intelligent cruise control, steering control systems and airbag.

##### Chapter No: 5. Automotive communication protocols

Overview of Automotive communication protocols, CAN, CAN FD, Automotive Ethernet, LIN, Flex Ray, MOST.

#### Unit III

##### Chapter No: 6. Overview of ADAS/AD and Functional Safety Standards

Advanced Driver Assistance Systems (ADAS), Autonomous driving: sensing, planning and control, connected vehicles. Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle.

##### Chapter No: 7. Vehicle Diagnostics

Introduction to vehicle diagnostics, onboard/off board Diagnostics, diagnostic tools, diagnostic fault codes, diagnostic protocols: KWP2000 and UDS.

##### Experiment List:

- Modeling and simulation of Electrical/Mechanical/ Electronics subsystems using Simulink/Simscape.
- Modeling and simulation of a vehicle motion on a flat surface during hard acceleration, deceleration and steady acceleration.
- Modeling and simulation of EGAS system.
- Modeling and simulation of the Fuel Control System and realization on the hardware platform.

- Modeling and simulation of wiper control system using state flow and realization on the hardware platform.
- Develop embedded C code for the power window system of an automobile and realization on the hardware platform.
- Develop embedded C code for seat belt warning system and realization on the hardware platform.
- Develop embedded C code to establish CAN communication between two ECUs.
- Develop embedded C code to Implement X by wire system and realization on the hardware platform.
- Realize ADAS feature to enhance vehicle safety and improve the driving experience on the target hardware.

**Text Books:**

1. Ribbens, Understanding of Automotive electronics, 6th Edition, Elsevier, 2003
2. Denton, Automobile Electrical and Electronic Systems, Elsevier, 3rd Edition, 2004
3. Konrad Reif Ed, Brakes, Brake Control and Driver Assistance Systems, Professional Automotive Information, Springer, 2014
4. David Smith, Kenneth Simpson, The Safety Critical Systems Handbook, 5th Edition, 2020

**Reference Books:**

1. Ronald K Jurgen, Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999
2. James D Halderman, Automotive electricity and Electronics, PHI Publication, 2000
3. Allan Bonnick, Automotive Computer Controlled Systems Diagnostic Tools and Techniques, Elsevier Science, 2001
4. Nicholas Navet, Automotive Embedded System Handbook, 2009

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                  |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: Computer Communication Networks I</b>                                                                                                                                                                                                                                                                                                 |                                    | <b>Course Code: 23EECC306</b>    |
| <b>L-T-P: 4-0-0</b>                                                                                                                                                                                                                                                                                                                                    | <b>Credits: 4</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                   | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 50Hrs</b>                                                                                                                                                                                                                                                                                                                           | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                          |                                    |                                  |
| <b>Chapter No.1.</b> Computer Networks and the Internet What is Internet? The Network Edge, the network Core, delay-loss, throughput in packet switched networks. Protocol layers (OSI layers) and their service models, networks under attack                                                                                                         |                                    |                                  |
| <b>Chapter No. 2.</b> Application Layer Principles of network applications, the web and HTTP, DHCP, electronic mail in the internet, DNS, peer-to-peer applications                                                                                                                                                                                    |                                    |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                                                                         |                                    |                                  |
| <b>Chapter No. 3.</b> Transport Layer Introduction and transport-layer services-relationship between transport and network layers - overview of the transport layer in the internet, multiplexing and de multiplexing, connectionless transport: UDP, principles of reliable data transfer, connection-oriented transport TCP, TCP congestion control. |                                    |                                  |
| <b>Chapter No. 4.</b> Network layer Introduction, virtual circuit and datagram networks, what's inside router? The Internet protocol (IP): forwarding and addressing in the internet.                                                                                                                                                                  |                                    |                                  |
| <b>Unit III</b>                                                                                                                                                                                                                                                                                                                                        |                                    |                                  |
| <b>Chapter No. 5.</b> Network layer: Routing algorithms: Link-State (LS), Distance-Vector (DV), Hierarchical Routing, Routing in the Internet, Intra-AS routing RIP, OSPF, Inter-AS routing BGP, broadcast routing algorithms and multi cast routing                                                                                                   |                                    |                                  |
| <b>Text Books:</b>                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| 1. Kurose & Ross, Computer Networking A Top-Down Approach, 6th edition, PEARSON, 2013.                                                                                                                                                                                                                                                                 |                                    |                                  |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| 1. Behrouz A. Forouzan, 1. Data Communications and Networking, 4th Edition, Tata McGraw, 2006                                                                                                                                                                                                                                                          |                                    |                                  |
| 2. Larry L. Peterson and Bruce S. Davie, Computer Networks A Systems Approach, 4th Edition, Elsevier, 2007                                                                                                                                                                                                                                             |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: GEN AI</b>                                                           |                                    | <b>Course Code: 24EECC308</b>    |
| <b>L-T-P: 2-0-1</b>                                                                   | <b>Credits: 3</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                  | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                          | <b>Examination Duration: 2 Hrs</b> |                                  |

## Unit I

### Chapter 1: Introduction to Generative AI

Definition, Overview of Generative AI, Importance and applications of Generative AI, Evolution of AI towards generative models, Key milestones and breakthroughs in Generative AI.

### Chapter 2: Generative Models I:

Autoencoders (AE) and Variational Autoencoders (VAEs) Architecture: Encoder, Decoder, Latent Space, Training with ELBO (Evidence Lower Bound), Applications and limitations.

Generative Adversarial Networks (GANs): Architecture: Generator and Discriminator, Training process, loss functions, Common issues, Variants: DCGAN, CycleGAN, StyleGAN.

Diffusion Models: Forward process (encoders), reverse process (decoders), score matching, guided diffusion.

### Chapter 3: Training and Evaluation of Generative AI Models:

Optimization Methods: Gradient Descent, Stochastic Gradient Descent (SGD), Adam Optimizer, Adam (Adaptive Moment Estimation), RMSProp (Root Mean Square Propagation), Adagrad (Adaptive Gradient Algorithm), AdaDelta.

Evaluation Metrics: Inception Score (IS), Frechet Inception Distance (FID), Perplexity, Reconstruction Error, Mode Score, Diversity Metrics, Wasserstein Distance, Earth Mover's Distance (EMD), BLEU Score

Challenges: Mode collapse, stability, and convergence.

## Unit II

### Chapter 4: Generative Models II: Autoregressive Models

Definition and Principle: Autoregressive Property, Conditional Dependence, Autoregressive Process

Examples of Autoregressive Models: AR Models in Time Series Analysis, Autoregressive Integrated Moving Average (ARIMA)

Autoregressive Models for Generative AI:

PixelCNN - Overview, Architecture, Training, Applications

WaveNet - Overview, Architecture, Training, Applications

### Chapter 5: Generative Models II: Transformers

Introduction to Transformers, Origins and evolution from traditional sequence models (like RNNs and LSTMs) to transformers, self-attention mechanism, multi-head attention, position-wise feedforward networks.

Transformer Architecture: breakdown of encoder and decoder stacks, Layer normalization and residual connections, Masked self-attention in the decoder for auto-regressive generation, Pre-training and Fine-tuning.

Transformer-based Autoregressive Models: Overview, Architecture, Training, Applications, BERT (Bidirectional Encoder Representations from Transformers), T5 (Text-to-Text Transfer Transformer)

**Chapter 6: Generative Models II: Large Language Models (LLMs)**

Introduction to LLMs, Overview of Large Language Models (e.g., GPT-3, GPT-4), Training methodologies and scalability, Integration of LLMs in various generative tasks, Fine-tuning and transfer learning with LLMs, Building and deploying LLM-based applications.

**Unit III****Chapter 7: Advanced Topics in Generative AI:**

Flow-Based Models, Invertibility, Volume Preservation, Normalizing Flows, Invertible Convolution, Coupling Layers Sparse Attention Mechanisms, Multimodal Generative Models, Meta-Learning and Few-Shot Learning, Continual Learning and Transfer Learning, Privacy-Preserving Generative Models, Quantum Generative Models.

**Chapter 8: Ethical Considerations and Responsible AI:**

Bias and fairness in generative AI models, Privacy concerns and data protection in generative AI applications, Responsible use of generative models in society

**Text Books / References:**

1. Christopher M. Bishop, Hugh Bishop, "Deep Learning - Foundations and Concepts", Springer 2024, ISBN 978-3-031-45467-7, pp. 1-607.
2. Akshay Kulkarni, Adarsha Shivananda, Anoosh Kulkarni, Dilip Gudivada, "Applied Generative AI for Beginners: Practical Knowledge on Diffusion Models, ChatGPT, and Other LLMs", 978-1-4842-9994-4, (2023), <https://doi.org/10.1007/978-1-4842-9994-4>.
3. Martin Musiol, "Generative AI: Navigating the Course to the Artificial General Intelligence Future". John Wiley & Sons Inc; 1st edition, (2024), ISBN-13: 978-1394205912, 1-288 pages.
4. Jospeh Babcock and Raghav Bali, "Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models", Packt Publishing (2021); Packt Publishing Limited, 1-488 Pages, ISBN-13: 978-1800200883.

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: Computer Communication Networks I Lab</b>                            |                                    | <b>Course Code: 23EECP303</b>    |
| <b>L-T-P: 0-0-1</b>                                                                   | <b>Credits: 1</b>                  | <b>Contact Hours: 2 Hrs/week</b> |
| <b>ISA Marks: 80</b>                                                                  | <b>ESA Marks: 20</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: --</b>                                                             | <b>Examination Duration: 2 Hrs</b> |                                  |

**Experiment wise plan**

1. Implement echo server using socket.
2. Implement a chat application using multiple client sockets.
3. Write a program to transfer a file from server using sockets.
4. Write a program for implement Cyclic Redundancy Check
5. Introduction to network operating system
6. Configure and demonstrate a VLAN.
7. Configure and analyze OSPF
8. Configure and demonstrate DHCP

OPEN ENDED:

9. Configure and analyze BGP

OR

10. Implement a Socket application

**Text Books**

1. Kurose & Ross, Computer Networking A Top-Down Approach, 6<sup>th</sup> edition PEARSON, 2013.

**Reference Books:**

1. Cisco networking academy, <https://www.netacad.com/>
2. Juniper networking academy, <https://learningportal.juniper.net/>

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|----------------------------------------------------------------------------|----------------------------|----------------------------|
| Program: Bachelor of Engineering (Electronics & Communication Engineering) |                            | Semester:VI Semester       |
| Course Title: Minor Project I                                              |                            | Course Code: 24EECW302     |
| L-T-P: 0-0-6                                                               | Credits: 6                 | Contact Hours: 12 Hrs/week |
| ISA Marks: 50                                                              | ESA Marks: 50              | Total Marks: 100           |
| Teaching Hours: 14Hrs                                                      | Examination Duration:2 Hrs |                            |

Application Areas are,

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Agriculture

**Guide lines for selection of a project:**

1. The project needs to encompass the concepts learnt in a subject/s studied in the previous five semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the minor-projects.
2. Student can select a project which leads to a product or model or prototype.
3. Time plan: Effort to do the project should be between 120-150 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
4. Learning overhead should be 20-25% of total project development time.

**Criteria for group formation:**

1. 3-4 students in a team.
2. Role of teammates: Team lead and members.

**Allocation of Guides and Mentors for the projects:**

Every Project batch will be allocated with one faculty.

**Details of the project batches:**

1. Number of faculty members: 64
2. Number of students: 278

**Role of a Guide**

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

**How student should carry out a project:**



1. Define the problem
2. Specify the requirements
3. Specify the design in the understandable form (Block Diagram, Flowchart, Algorithm, etc)
4. Analyze the design
5. Select appropriate simulation tool and development board for the design.
6. Implement the design
7. Optimize the design and generate the results with optimized design.
8. Result representation and analysis
9. Prepare a document and presentation.

#### **Report Writing**

The format for report writing should be downloaded from <ftp://10.3.0.3/minorprojects>  
The report needs to be shown to guide and committee for each review.

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                             |                                   | <b>Semester:VI Semester</b>      |
| <b>Course Title: Analog Integrated Circuit Design</b>                                                                                                             |                                   | <b>Course Code: 24EECE301</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                               | <b>Credits: 3</b>                 | <b>Contact Hours: 5 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                              | <b>ESA Marks:33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                      | <b>Examination Duration:3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                     |                                   |                                  |
| 1. <b>Basic MOS Device Physics:</b> General considerations, MOS I/V characteristics, second order effects and MOS device models.                                  |                                   |                                  |
| 2. <b>Current Mirrors:</b> Basic current Mirror, Widlar, Cascode and Wilson Current Mirrors.                                                                      |                                   |                                  |
| 3. <b>Single Stage Amplifiers:</b> CS, CG, CD, Cascode and Folded Cascode. Frequency response curves.                                                             |                                   |                                  |
| <b>Unit II</b>                                                                                                                                                    |                                   |                                  |
| 4. <b>Differential Amplifiers:</b> Differential Amplifier, 5 pack differential Amplifier, CMRR, PSRR.                                                             |                                   |                                  |
| 5. <b>Op-Amp:</b> Performance parameters, two stage (7-pack) Op-amp, Slew rate, PSRR, Noise in Op-amps.                                                           |                                   |                                  |
| 6. <b>Compensation Technique:</b> Nyquist stability Criterion, Gain and Phase margins, Compensation of Two stage op-amp and Dominant pole compensation technique. |                                   |                                  |
| <b>Unit III</b>                                                                                                                                                   |                                   |                                  |
| 7. <b>Reference Circuits:</b> Current reference, startup circuits, Bandgap reference circuit, Current mode Bandgap reference.                                     |                                   |                                  |
| 8. <b>Comparators:</b> Basic Comparator architecture, non-idealities-offset error, bandwidth consideration, Dynamic comparator                                    |                                   |                                  |
| <b>Text Books:</b>                                                                                                                                                |                                   |                                  |
| 1. B Razavi 'Design of Analog CMOS Integrated Circuits' First Edition McGraw Hill 2001                                                                            |                                   |                                  |
| 2. Phillip. E. Allen, Douglas R. Holberg, "CMOS Analog circuit Design" Oxford University Press, 2002.                                                             |                                   |                                  |
| <b>Reference Books:</b>                                                                                                                                           |                                   |                                  |
| 1. Baker, Li, Boyce, "CMOS: Circuit Design, Layout and Simulation", Prentice Hall of India, 2000                                                                  |                                   |                                  |

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: Architectural Design of Integrated Circuits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                    | <b>Course Code: 24EECE302</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Credits: 3</b>                  | <b>Contact Hours: 5 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Examination Duration: 3 Hrs</b> |                                  |
| <p><b>Chapter No. 1. Digital Integrated Circuits</b><br/> Challenges in digital design, Design metrics, Cost of Integrated circuits, ASIC, Evolution of SoC ASIC Flow Vs SoC Flow, SoC Design Challenges. Introduction to CMOS Technology, PMOS &amp; NMOS Operation, CMOS Operation principles, Characteristic curves of CMOS, CMOS Inverter and characteristic curves, Delays in inverters, Buffer Design, Power dissipation in CMOS, CMOS Logic, Stick diagrams and Layout diagrams. Setup time, Hold Time, Timing Concepts.</p> <p><b>Chapter No. 2. System Building Blocks</b><br/> Modeling finite state Machines, Data Path and controller design, Synthesizable Verilog, Pipeline modelling</p> <p><b>Chapter No. 3. Design and simulation of Micro - Architectural blocks</b><br/> Efficient technique/s for Algorithm to Architecture Mapping, Recent Trends on Adder/Subtractor Design, Efficient VLSI Architectures for Various DSP blocks (FIR filter, CORDIC, FFT), Pipeline Implementation of Processor, Verilog Modeling of Processor</p> <p><b>Chapter No. 4. Timing Analysis</b><br/> Fundamentals of Efficient Design and Implementation strategies of Digital VLSI Design (Clock Tree synthesis, Timing Closure, Synthesis), Static Timing Analysis, Clock Skew.</p> |                                    |                                  |
| <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Digital Design by Morris Mano M, 4th Edition.</li> <li>2. Verilog HDL: A Guide to Digital Design and Synthesis by Samir Palnitkar, 2nd Edition.</li> <li>3. Principles of VLSI RTL Design: A Practical Guide by Sapan Garg, 2011.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                  |
| <b>Tools: Questa Sim, NC Verilog, NC Sim, CVER + GTKWave, VCSMX, Modelsim for Verilog</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   | <b>Semester:VI Semester</b>      |
| <b>Course Title: Embedded Intelligent Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   | <b>Course Code: 24EECE310</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Credits: 3</b>                 | <b>Contact Hours: 5 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>ESA Marks: 33</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 14Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Examination Duration:3 Hrs</b> |                                  |
| <p><b>1.Basics of embedded systems</b><br/>Linux Application Programming, System V IPC, Linux Kernel Internals and Architecture, Kernel Core, Linux Device Driver Programming, Interrupts &amp; Timers, Sample shell script, application program, driver source build and execute.</p> <p><b>2.Heterogeneous computing</b><br/>Basics of heterogeneous computing with various hardware architectures designed for specific type of tasks, Advanced heterogeneous computing with a. Introduction to Parallel programming b. GPU programming (OpenCL) c. Open standards for heterogeneous computing (Openvx), Basic OpenCL examples - Coding, compilation and execution.</p> <p><b>3.ML Frameworks lab with the target device</b><br/>Caffe, TensorFlow, TF Lite machine learning frameworks &amp; architecture, Model parsing, feature support and flexibility, supported layers, advantages and disadvantages with each of these frameworks, Android NN architecture overview, Full stack compilation and execution on embedded device.</p> <p><b>4. Model Development and Optimization</b><br/>Significance of on device AI, Quantization, pruning, weight sharing, Distillation, Various pre-trained networks and design considerations to choose a particular pre-trained model, Federated Learning, Flexible Inferencing.</p> <p><b>5.Android Anatomy</b><br/>Android Architecture, Linux Kernel, Binder, HAL Native Libraries, Android Runtime, Dalvik Application framework, Applications, IPC.</p> |                                   |                                  |
| <p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. Linux System Programming, by Robert Love, Copyright © 2007 O'Reilly Media</li> <li>2. Heterogeneous Computing with OpenCL, 2nd Edition by Dana Schaa, Perhaad Mistry, David R. Kaeli, Lee Howes, Benedict Gaster, Publisher: Morgan Kaufmann</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                  |
| <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Deep Learning, MIT Press book, Goodfellow, Bengio, and Courville's</li> <li>2. Beginning Android, by Wei-Meng Lee , Publisher: Wrox , O'Reilly Media</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                   |                                  |

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### Experiment wise plan

| Expt./Job No. | Experiment/job Details                                                                                                                               |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.            | Practice programs on Linux Application Programming, system IPC                                                                                       |
| 2.            | Implement toolchain, linker, and loaders while building Hello World on the host, then execute on target.                                             |
| 3.            | Basic OpenCL examples - Coding, compilation, and execution                                                                                           |
| 4.            | High-level language to assembly language translation – optimization and power management.                                                            |
| 5.            | Implementation of Caffe TensorFlow, TF Lite machine learning frameworks & architecture. Execution of sample programs with various pre-trained models |
| 6.            | Full stack compilation and execution on an embedded device. Quantization, pruning, weight sharing, Distillation execution with parameters.           |
| 7.            | Implement basic programs in the Android framework and implement Android NN architecture.                                                             |
| 8.            | Push the ML/DL model on an Android device and run the application.                                                                                   |
| 9.            | Design an ML/DL model for a given problem targeted at Android devices with different architectures based on provided specifications.                 |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: OOPS using C++</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    | <b>Course Code: 25EECE321</b>    |
| <b>L-T-P: 2-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Credits: 3</b>                  | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Examination Duration: 2 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter 1: Fundamental concepts of object-oriented programming:</b><br>Introduction to object-oriented programming, Programming Basics (keywords, identifiers, variables, operators, classes, objects), Arrays and Strings, Functions/ methods (parameter passing techniques).<br><b>Chapter 2: OOPs Concepts:</b><br>Overview of OOPs Principles, Introduction to classes & objects, Creation & destruction of objects, Data Members, Member Functions, Constructor & Destructor, Static class member, Friend class and functions, Namespace. |                                    |                                  |
| <b>Unit II</b><br><b>Chapter 3: Inheritance:</b><br>Introduction and benefits, Abstract class, Aggregation: classes within classes Access Specifier, Base and Derived class Constructors, Types of Inheritance. Function overriding.<br><b>Chapter 4: Polymorphism:</b><br>Virtual functions, Friend functions, static functions, this pointer.                                                                                                                                                                                                                    |                                    |                                  |
| <b>Unit III</b><br><b>Chapter 5: Exception Handling:</b><br>Introduction to Exception, Benefits of Exception handling, Try and catch block, throw statement, Pre-defined exceptions in C++, Writing custom Exception class.<br><b>Chapter 6: I/O Streams:</b><br>C++ Class Hierarchy, File Stream, Text File Handling, Binary File Handling<br>Error handling during file operations, Overloading << and >> operators                                                                                                                                              |                                    |                                  |
| <b>Text Books</b><br>1. Robert Lafore, "Object oriented programming in C++", 4 <sup>th</sup> Edition, Pearson education, 2009.                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>Reference Books:</b><br>1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.<br>2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill                                                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   | <b>Semester: VI Semester</b>     |
| <b>Course Title: Multimodal Machine Learning</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                   | <b>Course Code: 25EECE327</b>    |
| <b>L-T-P: 2-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Credits: 3</b>                 | <b>Contact Hours: 4 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>ESA Marks: 33</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Examination Duration: 2Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |                                  |
| <b>Chapter No.1: Introduction:</b> Multimodal AI technologies, Multimodal behavior and signals, Dimensions of heterogeneity, Multimodal data types (text, audio and images)                                                                                                                                                                                                                                                                                                                                                                  |                                   |                                  |
| <b>Chapter No. 2: Challenges in multimodality:</b> Representation, alignment, reasoning, generation, Transference and quantification                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |                                  |
| <b>Chapter No. 3: Tools for multimodal learning:</b> Introduction to deep learning techniques Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Auto Encoders and transformer- based models, and their application to multimodal data.                                                                                                                                                                                                                                                                                 |                                   |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |                                  |
| <b>Chapter No. 4 Natural Language Processing (NLP):</b> Techniques for processing and analyzing textual data, including tokenization, embedding, and language models including BERT and GPT                                                                                                                                                                                                                                                                                                                                                  |                                   |                                  |
| <b>Chapter No. 5 Computer Vision:</b> Techniques for processing and analyzing image and video data, including object detection, segmentation, and classification                                                                                                                                                                                                                                                                                                                                                                             |                                   |                                  |
| <b>Chapter No. 6 Audio processing:</b> Techniques for processing and analyzing audio data, including speech recognition, speaker identification, and music classification.                                                                                                                                                                                                                                                                                                                                                                   |                                   |                                  |
| <b>Unit III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |                                  |
| <b>Chapter No. 7 Knowledge distillation models:</b> Response based, Feature based and Relation based knowledge distillation models.                                                                                                                                                                                                                                                                                                                                                                                                          |                                   |                                  |
| <b>Chapter No. 8 Evaluation and optimization:</b> Techniques for evaluating multimodal machine learning models and optimizing their performance, including metrics, cross-validation, and hyperparameter tuning                                                                                                                                                                                                                                                                                                                              |                                   |                                  |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |                                  |
| <ol style="list-style-type: none"><li>1. Clark, Alexander, Chris Fox, and Shalom Lappin, eds. The handbook of computational linguistics and natural language processing. Vol. 118. John Wiley &amp; Sons, 2012.</li><li>2. Forsyth, David A., and Jean Ponce. Computer vision: a modern approach. prentice hall professional technical reference, 2002.</li><li>3. Christensen, Mads G. Introduction to audio processing. Springer, 2019.</li><li>4. Multimodal Machine Learning -CVPR 2022 Tutorial by Carnegie Mellon University</li></ol> |                                   |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                    | <b>Semester: VI Semester</b>     |
| <b>Course Title: Dynamics of Linear Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    | <b>Course Code: 24EECE341</b>    |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Credits: 3</b>                  | <b>Contact Hours: 3 Hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter No. 1. Mathematical Background</b><br>Vector subspace, linear combination linear dependent, Basis, Span, Rank, Row space, Column space, Linear transformations, Eigen values, Eigen Vectors.<br><b>Chapter No. 2. State Variable Analysis</b><br>Introduction, concepts of state, state variables and state model, state-space representation for linear systems, State space modelling of Electrical Systems, State space modelling of Mechanical Systems.                                                                                                                                                                                                                               |                                    |                                  |
| <b>Unit II</b><br><b>Chapter No. 3. State-space Representation</b><br>State Diagram, First Canonical form, Second Canonical Form, Jordan Canonical Form, Relationship between state equations and transfer function, Signal flow graph of state equations, Diagonalization (State transformation method), Time domain solution of state equations: Solution of homogeneous state equations, state transition matrix, evaluation of matrix exponential ( $e^{At}$ ), solution of non-homogeneous state equations, Properties of State Transition Matrix, Computation of State transition Matrix: Unforced and Forced systems, Computation based on Caley Hamilton Theorem, Evaluation using Similarity transformation. |                                    |                                  |
| <b>Unit III</b><br><b>Chapter No. 4. Controllability and Observability</b><br>Concept of Controllability and Observability, Controllability and Observability tests for continuous time systems: Gilbert test, Kalman's test, Complete Output Controllability, Pole placement techniques, Design via pole placement (Ackermann's formula), State observer design.                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>Text Books:</b> <ol style="list-style-type: none"> <li>1. Katsuhiko Ogata, Discrete Time Control Systems, Prentice Hall of India Pvt. Ltd, 1995</li> <li>2. I. J. Nagrath and M. Gopal, Control Systems Engineering, 5<sup>th</sup>, New Age International (P) Limited, 2011</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. M. Gopal, Digital Control and State variable methods, TATA McGraw Hill Company</li> <li>2. Benjamin C. Kuo, Digital Control Systems, Oxford University Press, USA, 1995</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                  |

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## 7<sup>th</sup> Semester:

|                                                             |                                    |                                  |
|-------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Wireless and Mobile Networks</b>           |                                    | <b>Course Code: 25EECC403</b>    |
| <b>L-T-P: 2-0-1</b>                                         | <b>Credits: 3</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 67</b>                                        | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                | <b>Examination Duration: 2 Hrs</b> |                                  |

### Unit I

**Chapter No. 1. Local Area Networks:** Error-detection and correction techniques, multiple access links and protocols, Link-Layer Addressing and ARP, Ethernet 802.3, Token ring 802.5, FDDI and LAN standards, Link-Layer Switches, Virtual Local Area Networks (VLANs).

**Chapter No. 2. Wireless Networks:** Introduction, Wireless Links and Network Characteristics, CDMA, WiFi: 802.11 Wireless LANs, The 802.11 Architecture, The 802.11 MAC Protocol, The IEEE 802.11 Frame, Mobility in the Same IP Subnet, Advanced Features in 802.11, Personal Area Networks: Bluetooth and Zigbee.

### Unit II

**Chapter No. 3 Cellular Networks:** An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular Subscribers, 4G LTE Cellular Networks: Architecture and Elements, LTE Protocols Stacks, LTE Radio Access Network, Additional LTE Functions: Network Attachment and Power Management, The Global Cellular Network: A Network of Networks

**Chapter No. 4: 5G Networks-1:** Basics of 5G Technology: Overview of 5G architecture, Layered Architecture, Key features and requirements, Spectrum considerations for 5G

**Mobility Management:** Principles, Device Mobility: a Network-layer Perspective, Home Networks and Roaming on Visited Network, Direct and Indirect Routing to/from a Mobile Device, Mobility Management in Practice, Mobility Management in 5G Networks Mobile IP, Wireless and Mobility: Impact on Higher-Layer Protocols

### Text Book (List of books as mentioned in the approved syllabus)

- 1.Kurose & Ross, Computer Networking A Top-Down Approach, 6th edition, PEARSON, 2013.
- 2.5G NR: The Next Generation Wireless Access Technology & quote; Erik Dalman, Stefan Parkvall, Johan Sköld , Academic Press

### References

- 1.Behrouz A. Forouzan, 1. Data Communications and Networking, 4th Edition, Tata McGraw, 2006
- 2.Larry L. Peterson and Bruce S. Davie, Computer Networks A Systems Approach, : 4th Edition, Elsevier, 2007

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    | <b>Semester: VII</b>             |
| <b>Course Title: CIPE &amp; EVS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    | <b>Course Code: 15EHSC402</b>    |
| <b>L-T-P: 2-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Credits: Audit</b>              | <b>Contact Hours: 2 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                  |
| <p><b>Chapter No. 1 Features of Indian Constitution</b> : Features of Indian Constitution, Preamble to the constitution of India, Fundamental rights under Part III – details of Exercise of rights, Limitations &amp; Important cases. Berubari Union and Exchange of Enclaves, Kesavan and Bharati vs. UOI, Maneka Gandhi vs. UOI, Air India Ltd. vs. NargeesMeerza, T.M.A. Pai Foundation v. St. of Karnataka, M.C. Mehta vs. UOI etc.,</p> <p><b>Chapter No. 2 Relevance of Directive principles of State Policy</b> : Relevance of Directive principles of State Policy under Part IV, Fundamental duties &amp; their significance. SarlaMudgal v. UOI</p> <p><b>Chapter No. 3 Union</b> : Union – President, Vice President, Union Council of Ministers, Prime Minister, Parliament &amp; the Supreme Court of India.</p> <p><b>Chapter No.4 State</b> : State – Governors, State Council of Ministers, Chief Minister, State Legislature and Judiciary.</p> <p><b>Chapter No. 5 Constitutional Provisions for Scheduled Castes &amp; Tribes</b> : Constitutional Provisions for Scheduled Castes &amp; Tribes, Women &amp;Children &amp; Backward classes, Emergency Provisions.</p> <p><b>Chapter No. 6 Electoral process</b> : Electoral process, Amendment procedure, 42nd, 44th and 86th Constitutional amendments.</p> |                                    |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <p><b>Chapter No. 7 Scope &amp; Aims of Engineering Ethics</b> : Scope &amp; Aims of Engineering Ethics: Meaning and purpose of Engineering Ethics, Responsibility of Engineers, Impediments to responsibility, Honesty, Integrity and reliability, risks, safety &amp; liability in engineering. Bhopal Gas Tragedy, Titanic case.</p> <p><b>Chapter No. 8 Intellectual Property Rights</b> : Intellectual Property Rights (IPRs)- Patents, Copyright and Designs</p> <p><b>Chapter No. 9 Ethical perspectives of professional bodies</b> :Ethical perspectives of professional bodies- IEEE, ASME, NSPE and ABET, ASCE etc.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                  |
| <b>Unit III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                  |
| <p><b>Chapter No. 10 Effects of human activities on environment</b><br/>Effects of human activities on environment - Agriculture, Housing, Industry, Mining, and Transportation activities, Environmental Impact Assessment, Sustainability and Sustainable Development.</p> <p><b>Chapter No. 11 Environmental Protection</b><br/>Environmental Protection – Constitutional Provisions and Environmental Laws in India.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    |                                  |
| <b>Text Book (List of books as mentioned in the approved syllabus)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |

1. Dr. J. N. Pandey, "Constitutional Law of India", Central Law Agency, 2005
2. Dr. M.K. Bhandari, "Law relating to Intellectual Property Rights", Central Law Publications, Allahabad, 2010.
3. Charles E. Harris and others, "Engineering Ethics: Concepts and Cases", Thomson Wadsworth, 2003

#### References

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice-hall EEE, 2001
2. Mike Martin and Ronald Schinzinger, "Ethics in Engineering", Tata McGraw-Hill Publications.

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|--------------------------------------------------|-----------------------------|----------------------------|
| Program: Electronics & Communication Engineering |                             | Semester: VII              |
| Course Title: Senior Design Project              |                             | Course Code: 20EECW401     |
| L-T-P: 0-0-6                                     | Credits: 6                  | Contact Hours: 12 hrs/week |
| ISA Marks: 50                                    | ESA Marks: 50               | Total Marks: 100           |
| Teaching Hours: --                               | Examination Duration: 3 Hrs |                            |

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Automation of Agriculture

#### Guide lines for selection of a project:

- The project needs to encompass the concepts learnt in the previous semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the project work.
- Student can select a project which leads to a product or model or prototype.
- Time plan: Effort to do the project should be between 60-70 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
- Learning overhead should be 20-25% of total project development time.

#### Criteria for group formation:

- 3-4 students in a team.
- Role of teammates: Team lead and members.

#### Allocation of Guides and Mentors for the projects:

Every Project batch will be allocated with one faculty.

#### Details of the project batches:

- Number of faculty - members: 50
- Number of students: 3-4 students in a team.

#### Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

#### How student should carry out a project:

- Define the problem.
- Specify the requirements.
- Specify the design in the understandable form (Block Diagram, Flowchart, Algorithm, etc).
- Analyze the design and identify hardware and software components separately.
- Select appropriate simulation tool and development board for the design.
- Implement the design.
- Optimize the design and generate the results.
- Result representation and analysis.



- **Prepare a document and presentation.**

#### **Report Writing**

- **The format for report writing should be downloaded from ftp://10.3.0.3/projects**
- **The report needs to be shown to guide and committee for each review.**
- 

#### **Evaluation Scheme**

- **Internal semester assessment (ISA)**
- **Evaluation is done based on the evaluation rubrics given in Table 1**
- **Project shall be reviewed and evaluated by the concerned Guide for 50% of the marks.**
- **Project shall be evaluated by the review committee for 50% of the marks.**

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## 7<sup>th</sup> semester Electives

|                                                                                                                                                                                                                                                                                                                                           |                                    |                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                               |                                    | <b>Semester: VII</b>             |
| <b>Course Title: System Verilog for Verification</b>                                                                                                                                                                                                                                                                                      |                                    | <b>Course Code: 25EECE418</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                       | <b>Credits: 3</b>                  | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                      | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 14 Hrs</b>                                                                                                                                                                                                                                                                                                             | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Verification Concepts</b><br>Concepts of verification, importance of verification, Stimulus vs Verification, functional verification, test bench generation, functional verification approaches, typical verification flow, stimulus generation, direct testing, Coverage: Code and Functional coverage, coverage plan. |                                    |                                  |
| <b>Chapter No. 2. System Verilog – Language Constructs</b><br>System Verilog constructs - Data types: two-state data, strings, arrays: queues, dynamic and associative arrays, Structs, enumerated types. Program blocks, module, interfaces, clocking blocks, mod-ports.                                                                 |                                    |                                  |
| <b>Chapter No. 3. System Verilog – Classes &amp; Randomization</b><br>SV Classes: Language evolution, Classes and objects, Class Variables and Methods, Class instantiation, Inheritance, and encapsulation, Polymorphism.<br>Randomization: Directed Vs Random Testing. Randomization: Constraint Driven Randomization.                  |                                    |                                  |
| <b>Chapter No. 4. System Verilog – Assertions &amp; Coverage</b><br>Assertions: Introduction to Assertion based verification, Immediate and concurrent assertions. Coverage driven verification: Motivation, Types of coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling.                         |                                    |                                  |
| <b>Chapter No. 5. Building Testbench</b><br>Layered testbench architecture. Introduction to Universal Verification Methodology, Overview of UVM Base Classes and simulation phases in UVM and UVM macros. Unified messaging in UVM, UVM environment structure, Connecting DUT- Virtual Interface                                          |                                    |                                  |
| <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. System Verilog LRM</li> <li>2. Chris Spear, Gregory J Tumbush – System Verilog for verification - a guide to learning the testbench language features - Springer, 2012</li> </ol>                                                                                        |                                    |                                  |
| <b>Tools: Questa Sim, NC Verilog, NC Sim, CVER + GTKWave, VCSMX, Modelsim for Verilog</b>                                                                                                                                                                                                                                                 |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                             |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Speech Processing</b>                                                                                                                                                                  |                                    | <b>Course Code: 24EECE422</b>    |
| <b>L-T-P: 2-0-1</b>                                                                                                                                                                                     | <b>Credits: 3</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                    | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                            | <b>Examination Duration: 2 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                           |                                    |                                  |
| <b>Chapter 1: Introduction</b> : Speech production and perception, nature of speech; short-term processing: need, approach, time, frequency and time-frequency analysis.                                |                                    |                                  |
| <b>Chapter 2: Short-term Fourier transform (STFT)</b> : Overview of Fourier representation, non-stationary signals, development of STFT, transform and filter-bank views of STFT.                       |                                    |                                  |
| <b>Chapter 3: Cepstrum analysis</b> : Basis and development, delta, delta-delta and mel-cepstrum, homomorphic signal processing, real and complex cepstrum.                                             |                                    |                                  |
| <b>Unit II</b>                                                                                                                                                                                          |                                    |                                  |
| <b>Chapter No 4: Linear Prediction (LP) analysis</b> : Basis and development, Levinson-Durbin's method, normalized error, LP spectrum, LP cepstrum, LP residual.                                        |                                    |                                  |
| <b>Chapter 5: Sinusoidal analysis</b> : Basis and development, phase unwrapping, sinusoidal analysis and synthesis of speech.                                                                           |                                    |                                  |
| <b>Chapter 6: Mathematical models and Applications</b> : Gaussian mixture models and hidden Markov models                                                                                               |                                    |                                  |
| <b>Unit III</b>                                                                                                                                                                                         |                                    |                                  |
| <b>Chapter No 7: Introduction to Bayesian Approach</b> : Bayesian classification, Bayesian Learning, Bayes Optimal Classifier, Naive Bayes Classifier and Bayesian Network.                             |                                    |                                  |
| <b>Chapter 8: Introduction to Speech Technologies</b> : Automatic Speech recognition, speaker recognition, speaker diarization, speech synthesis, language and dialect identification and speech coding |                                    |                                  |
| <b>Text Books:</b>                                                                                                                                                                                      |                                    |                                  |
| 1. L.R. Rabiner and R.W. Schafer, Digital Processing of Speech Signals Pearson Education, Delhi, India, 2004                                                                                            |                                    |                                  |
| 2. J. R. Deller, Jr., J. H. L. Hansen and J. G. Proakis Discrete-Time Processing of Speech Signals, Wiley-IEEE Press, NY, USA, 1999.                                                                    |                                    |                                  |
| <b>Reference Books:</b>                                                                                                                                                                                 |                                    |                                  |
| 1. D. O'Shaughnessy, Speech Communications: Human and Machine, Second Edition, University Press, 2005.                                                                                                  |                                    |                                  |
| 2. T. F. Quatieri, "Discrete time processing of speech signals", Pearson Education, 2005.                                                                                                               |                                    |                                  |
| 3. L. R. Rabiner, B. H. Jhuang and B. Yegnanarayana, "Fundamentals of speech recognition", Pearson Education, 2009.                                                                                     |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                           |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Multimedia Communication</b>                                                                                                                                                         |                                    | <b>Course Code: 18EECE410</b>    |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                   | <b>Credits: 3</b>                  | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                  | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                         |                                    |                                  |
| <b>Chapter 1: Introduction to Multimedia:</b> Multimedia and Hyper media, WWW, overview of multimedia software tools.                                                                                 |                                    |                                  |
| <b>Chapter 2: Graphics and Image representation:</b> Graphics / Image data types, Popular file formats.                                                                                               |                                    |                                  |
| <b>Chapter 3: Fundamental concepts in video:</b> Types of video signals, analog video, digital video.                                                                                                 |                                    |                                  |
| <b>Chapter 4: Basics of digital audio:</b> Digitization of sound, MIDI, Quantization and transmission of audio.                                                                                       |                                    |                                  |
| <b>Unit II</b>                                                                                                                                                                                        |                                    |                                  |
| <b>Chapter 4: Lossless compression algorithms:</b> Introduction, run-length coding, variable length coding, dictionary-based coding, arithmetic coding, lossless image compression.                   |                                    |                                  |
| <b>Chapter 5: Lossy compression algorithms:</b> Introduction, distortion measures, quantization, transform coding, wavelet-based coding, wavelet packets, embedded zero tree of wavelet coefficients. |                                    |                                  |
| <b>Chapter 6: Image compression standards:</b> The JPEG standard, The JPEG2000 standard, The JPEG-LS standard, Bi level image compression standard.                                                   |                                    |                                  |
| <b>Unit III</b>                                                                                                                                                                                       |                                    |                                  |
| <b>Chapter 7: Basics video compression techniques:</b> Overview, video compression based on motion compensation, H.261                                                                                |                                    |                                  |
| <b>Chapter 8: Overview of MPEG-1, 2 4 and 7.</b>                                                                                                                                                      |                                    |                                  |
| <b>Text Books</b>                                                                                                                                                                                     |                                    |                                  |
| 1. Ze-Nian Li & Mark S Drew, "Fundamentals of multimedia", Pearson Education, 2004.                                                                                                                   |                                    |                                  |
| <b>References</b>                                                                                                                                                                                     |                                    |                                  |
| 1. Ralf Steinmetz & Kalra Nahrstedt, "Multimedia: Computing, Communication & Applications", Pearson Education, 2004                                                                                   |                                    |                                  |
| 2. K R Rao, Zoran S Bojkovic, Dragord A Milovanvic, Pearson education, "Multimedia communication systems: Techniques, Standards, & Networks", Second Indian reprint, 2004.                            |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                          |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Physical Design - Analog</b>                                                                                                                                                                        |                                    | <b>Course Code: 25EECE419</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                  | <b>Credits: 3</b>                  | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                 | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 14 Hrs</b>                                                                                                                                                                                        | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No 1. Standard cell Layout creation</b>                                                                                                                                                                   |                                    |                                  |
| Layout Practice Sessions (DRC/LVS Dirty layout), Understanding verification errors, Error debugging skills, Hands on experience of using layout editor, Quality of the layout, Half DRC rules, Mega module creation. |                                    |                                  |
| <b>Chapter No 2. Analog layout</b>                                                                                                                                                                                   |                                    |                                  |
| Importance of performance in Analog layout, Importance of floor planning and placement, Attributes need to be taken care during routing stage, Introduction to DRC, LVS, Density and RCX.                            |                                    |                                  |
| <b>Chapter No 3. Matching</b>                                                                                                                                                                                        |                                    |                                  |
| Introduction to mismatch concepts, Causes for mismatch, Types of mismatches, Rules for matching, Activities.                                                                                                         |                                    |                                  |
| <b>Chapter No 4. Guard ring and shielding</b>                                                                                                                                                                        |                                    |                                  |
| Guard ring- need of guard ring, what is guard ring, Usage of guard ring shielding- What is shielding, Types of shielding, importance of shielding.                                                                   |                                    |                                  |
| <b>Chapter No 5. Physical design of amplifier and buffer</b>                                                                                                                                                         |                                    |                                  |
| Applying the studied concepts and doing layout, Prioritising the constraints given, Quality checks, Buddy reviews and implementations, Documentation                                                                 |                                    |                                  |
| <b>References</b>                                                                                                                                                                                                    |                                    |                                  |
| <ol style="list-style-type: none"><li>1. The Art of Analog Layout – Alan Hastings</li><li>2. CMOS IC layout – Dan Clien</li><li>3. IC Layout Basics – Chris saint and Judy saint</li></ol>                           |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    | <b>Semester: VII</b>             |
| <b>Course Title: CMOS ASIC Design</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    | <b>Course Code: 25EECE420</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Credits: 3</b>                  | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 14 Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Introduction:</b><br>Design of combinational and sequential logic gates in CMOS. Layout and characterization of standard cells. Verilog for representing gate level netlists.                                                                                                                                                                                                                                                                                        |                                    |                                  |
| <b>Chapter No. 2. Timing Analysis:</b><br>Sequential circuit timing and static timing analysis. Cell and net delays and cross-talk. Rationale and implementation of scan chains for testing standard-cell based logic circuits. Timing Verification: Setup Timing Check, Hold Timing Check, Timing across Clock Domains                                                                                                                                                                |                                    |                                  |
| <b>Chapter No. 3: Physical design</b><br>Physical design of standard-cell based CMOS ASICs: scan insertion, placement, and clock tree synthesis and routing. Netlist transformations at each step of the physical design process. Net parasitic and parasitic extraction. Use of PLLs for clock generation and de-skew.                                                                                                                                                                |                                    |                                  |
| <b>Chapter No. 4. Standard Data formats:</b><br>Standard data formats for representing technology and design: LEF, Liberty, SDC, DEF and SPEF. Clock gating and power gating for reduction of device power consumption. Design for reliability: electro-migration, wire self heat and ESD checks and fixes.                                                                                                                                                                            |                                    |                                  |
| <b>Chapter No. 5. Packaging</b><br>An overview of package design and implementation and system level timing.                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                  |
| <b>Reference Books:</b> <ol style="list-style-type: none"><li>1. The Design &amp; Analysis of VLSI Circuits, L. A. Glassey &amp; D. W. Dobbepahl, Addison Wesley Pub Co. 1985.</li><li>2. H. Bhatnagar, Advanced ASIC Chip Synthesis Using Synopsys Design Compiler Physical Compiler and Prime Time, 2nd edition, 2001.</li><li>3. Static Timing Analysis for Nanometre Designs A Practical Approach, J. Bhasker • Rakesh Chadha, Springer Science Business Media, LLC 2009</li></ol> |                                    |                                  |
| <b>Tools: Cadence Innovous, Encounter</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Microwave &amp; Antenna</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    | <b>Course Code: 23EECE411</b>    |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Credits: 3</b>                  | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter No. 1. Microwave Vacuum Tube Devices:</b> Introduction, Reflex Klystron, Problems.<br><b>Chapter No. 2. Microwave Network Theory &amp; Passive Devices:</b> Introduction, S- Matrix Representation of Multiport network, Microwave Passive Devices: Directional couplers, Circulators, Magic T, Isolator, Attenuators, Numerical. Microwave Applications: Microwave Radar systems, microwave communication system, industrial applications of microwave: Microwave heating, thickness and moisture content measurement.                                                                                                                                                                                                               |                                    |                                  |
| <b>Unit II</b><br><b>Chapter No. 3. Antenna Parameters:</b> Introduction, Basic antenna parameters, Pattern, Beam width, Radiation intensity, Beam efficiency, Directivity, Gain, Aperture, Effective height, Polarization, Antenna field zone, The radio communication link. Radiation resistance of Short electric dipole and half wave length antenna.<br><b>Chapter No. 4. Sources and Arrays:</b> Introduction, Point sources, Power patterns, Power theorem, Examples on power theorem, Directivity and beam width of point sources, Arrays of two isotropic point sources, Non isotropic but similar point sources and Pattern multiplication, Linear array of n isotropic point sources of equal amplitude and spacing, Broad side array, End fire array. |                                    |                                  |
| <b>Unit III</b><br><b>Chapter No. 5. Antenna practice:</b> Yagi-Uda Antenna, Dipole/Monopole antenna, Loop antenna, Horn antenna, Parabolic reflector, Helical antenna, Log periodic antenna, Microstrip Patch Antenna, Mobile Station Antennas, Antennas for GPR: Pulse Bandwidth, Embedded Antennas, UWB Antennas for Digital Applications, The Plasma Antenna, Types of antenna for 4G/LTE and 5G.                                                                                                                                                                                                                                                                                                                                                             |                                    |                                  |
| <b>Text Book (List of books as mentioned in the approved syllabus)</b> <ol style="list-style-type: none"> <li>1. Annapurna Das, Sisir K Das, Microwave engineering, TMH Publications, 2001.</li> <li>2. J.D. Kraus &amp; Khan, Antennas, third edition, MGH publication, 2006.</li> <li>3. Liao, Microwave Devices and Circuits, PHI Pearson Education.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| <b>References</b> <ol style="list-style-type: none"> <li>1. John Krauss and Daniel, Electromagnetics with Applications, 5th, McGraw-Hill, 1999.</li> <li>2. E.C.Jordan, Electromagnetic waves &amp; radiating systems, second edition, PHI publication.</li> <li>3. K.D.Prasad, "Antenna and wave propagation" first edition, 1990.</li> <li>4. C.A.Balnis "Antenna theory and analysis and design", third edition,1999.</li> </ol>                                                                                                                                                                                                                                                                                                                               |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: VII</b>             |
| <b>Course Title: AUTOSAR</b>                                |                                    | <b>Course Code: 25EECE406</b>    |
| <b>L-T-P: 2-0-1</b>                                         | <b>Credits: 3</b>                  | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks: 67</b>                                        | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 26 Hrs</b>                               | <b>Examination Duration: 2 Hrs</b> |                                  |

## Chapter No. 1: AUTOSAR Fundamentals

Evolution of AUTOSAR – Motivations and Objectives AUTOSAR consortium – Stake holders – work Packages, AUTOSAR Partnership, Goals of the partnership, Organization of the partnership, AUTOSAR specification, AUTOSAR Current development status, BSW Conformance classes: ICC1, ICC2, ICC3, and Drawbacks of AUTOSAR.

## Chapter No. 2: AUTOSAR layered Architecture

AUTOSAR Basic software, Details on the various layers , Details on the stacks Virtual Function Bus (VFB) Concept Overview of AUTOSAR Methodology , Tools and Technologies for AUTOSAR Application Software Component (SW-C) ,Types of SW-components AUTOSAR Run Time Environment (RTE): RTE Generation Process: Contract Phase, Generation Phase, MCAL, IO HW Abstraction Layer, Partial Networking, Multicore, J1939 Overview, AUTOSAR Ethernet, AUTOSAR E2E Overview , AUTOSAR XCP, Metamodel , From the model to the process , Software development process.

## Chapter No. 3: Methodology of AUTOSAR and Communication in AUTOSAR

CAN Communication, CAN FD, CANape, Application Layer and RTE, intra and inter ECU communication, Client-Server Communication, Sender-Receiver, Communication, CAN Driver, Communication Manager (ComM), Overview of Diagnostics Event and Communication Manager

## Chapter No. 4: Overview about BSW constituents

BSW Constituents: Memory layer, COM and Services layer, ECU abstraction, AUTOSAR, operating system, Interfaces: Standard interface, AUTOSAR standardized interface, BSW-RTE interface, (AUTOSAR interface), BSW-ECU hardware interface, Complex device drivers and BSW module configuration, AUTOSAR Integration.

## Chapter 5: MCAL and ECU abstraction Layer

Microcontroller Drivers, Memory drivers: on-chip and off chip drivers, IO drivers (ADC, PWM, DIO), Communication drivers: CAN driver, LIN drivers, Flexray

## Chapter 6: Service Layer

Diagnostic Event Manager, Function inhibits Manager, Diagnostic communication manager, Network management, Protocol data unit router, Diagnostic log and trace unit, COMM manager.

## Text Book (List of books as mentioned in the approved syllabus)

1. Ronald K. Jurgen, Infotainment systems, 2007, SAE International, 2007

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                          |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Human Machine Interface</b>                                                                                                         |                                    | <b>Course Code: 25EECE428</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                  | <b>Credits: 3</b>                  | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                 | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 14 Hrs</b>                                                                                                                        | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                        |                                    |                                  |
| <b>Chapter 1: Introduction to HMI</b>                                                                                                                |                                    |                                  |
| Overview of HMI, general introduction to HMI, HMI Architecture & Concepts/HMI Sub-Components (Widgets, Framework, state machine)                     |                                    |                                  |
| <b>Chapter 2: Automotive HMI</b>                                                                                                                     |                                    |                                  |
| Evolution of HMI in cars, HMI for car multimedia, GUI Tools (GTK, QT, HTML5)                                                                         |                                    |                                  |
| Lab: Widget design using GUI tools                                                                                                                   |                                    |                                  |
| <b>Chapter 3: UX and Guidelines</b>                                                                                                                  |                                    |                                  |
| Introduction to UX design (theory, design thinking), graphics design (Blender, GIMP), 2D/3D rendering, OpenGL, GPU architectures, shader programming |                                    |                                  |
| Lab: UX design using OpenGL, rendering using Blender.                                                                                                |                                    |                                  |
| <b>Unit II</b>                                                                                                                                       |                                    |                                  |
| <b>Chapter 4: Car Multimedia</b>                                                                                                                     |                                    |                                  |
| Instrument cluster, in-vehicle infotainment, professional system/ rear-seat entertainment.                                                           |                                    |                                  |
| Lab: Design instrument cluster for dashboard and infotainment control                                                                                |                                    |                                  |
| <b>Chapter 5: App Development and Testing</b>                                                                                                        |                                    |                                  |
| App development for Android/ iOS, Unity, HMI testing and automation                                                                                  |                                    |                                  |
| Lab/ Project: Design an app to control vehicle infotainment system using a mobile device                                                             |                                    |                                  |
| <b>Chapter 6: Advanced Topics</b>                                                                                                                    |                                    |                                  |
| Voice/ Gesture control, haptics, eye gaze sensor, Virtual/ Augmented Reality, Analytics                                                              |                                    |                                  |
| <b>References:</b>                                                                                                                                   |                                    |                                  |
| 1. The Handbook of Human-Machine Interaction: A Human-Centered Design Approach. Eds. G. A. Boy, CRC Press.                                           |                                    |                                  |
| 2. Designing for Situation Awareness: An Approach to User-Centered Design. M. R. Endsley & D. G. Jones, CRC Press.                                   |                                    |                                  |
| 3. The Humane Interface: New Directions for Designing Interactive Systems. J. Raskin, Addison-Wesley.                                                |                                    |                                  |
| 4. Tutorials for tools/ libraries: Blender, GIMP, GTK, QT, unity, OpenGL                                                                             |                                    |                                  |

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| <b>Program: Electronics &amp; Communication Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Wireless &amp; Mobile Communication</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    | <b>Course Code: 24EECE432</b>    |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Credits: 3</b>                  | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter 01 Radio Propagation</b><br>Free space propagation model, Relating power to electric field., Relation, ground reflection, scattering, Practical link budget design using path loss model, Outdoor propagation models, Signal penetration into buildings, Ray tracking and site specific modelling, Small scale Multipath measurements, Parameters of mobile Multipath channels, Types of small scale fading.                                                                                                                                                                                                                                          |                                    |                                  |
| <b>Unit II</b><br><b>Chapter 02 Diversity techniques</b><br>Concept of Diversity branch and signal paths, Combining and switching methods, C/N, C/I performance improvements, RAKE receiver.<br><b>Chapter 03 Cellular concept</b><br>Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trucking and grade of service, improving coverage, Capacity in cellular systems, FDMA, TDMA, Pseudo noise sequences, notion of spread spectrum, processing gain and Jamming margin, direct sequence spread spectrum, frequency hop spread spectrum, Spread spectrum multiple access, SDMA packet radio. Capacity of cellular systems. |                                    |                                  |
| <b>Unit III</b><br><b>Chapter 4: 5G:</b> Implementation, components of the 5G, 5G architecture, 5G design, 5G network, 5G applications, Advantages and disadvantages<br><b>Chapter 5: Satellite orbits GEO, MEO, LEO and applications.</b><br>Fiber to the home (FTTH): Working, FTTH architecture and components, benefits, advantages and disadvantages                                                                                                                                                                                                                                                                                                                         |                                    |                                  |
| <b>Text Book (List of books as mentioned in the approved syllabus)</b><br>1. T.S. Rapport, Wireless Communication, 2, Pearson Education, 2002                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>References</b><br>1. Kamil O Feher, Wireless digital communications: Modulation and spread spectrum Techniques, Prentice Hall of India, 2004<br>2. Vijay K Garg, IS_95 CDMA and cdma 2000, Pearson publication pvt. Ltd, 2004<br>3. Xiaodong Wang and Vincent Poor, wireless Communicating system: Advanced Techniques for signal Reception, Pearson publication pvt. Ltd, 2004                                                                                                                                                                                                                                                                                                |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                     | <b>Semester: VII</b>             |
| <b>Course Title: 5G &amp; Software Defined Networking</b>                             |                                     | <b>Course Code: 24EECE434</b>    |
| <b>L-T-P: 3-0-0</b>                                                                   | <b>Credits: 3</b>                   | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                  | <b>ESA Marks: 50</b>                | <b>Total Marks:100</b>           |
| <b>Teaching Hours: 40Hrs</b>                                                          | <b>Examination Duration: :3 Hrs</b> |                                  |

## Unit I

### Chapter No. 1: Overview of 5G Technology

Introduction to 5G NR and its importance in wireless communication

Evolution from previous generations (1G to 4G) and key differences

Use cases and applications of 5G technology

Overview of 5G architecture and protocol stack

Exploring NS-3 (Network Simulator 3) for code development

### Chapter No. 2. Physical Layer Design and Techniques

Physical layer in 5G NR, waveforms, numerology, and frame structure

Understanding modulation, coding, and MIMO techniques in 5G NR

Hands-on exercises on simulating and implementing physical layer techniques using C/NS-3

- Simulating Basic NR Waveforms
- Implementing 5G NR Frame Structure
- Coding and Decoding Techniques in 5G NR

### Chapter No. 3. Protocol Stack and Radio Access Network (RAN)

Overview of the protocol stack layers in 5G NR, including PHY, MAC, RLC, PDCP, and RRC. Understanding the functions and interactions between different protocol layers. 5G RAN architecture, including gNBs (Next-Generation NodeBs) and NG-RAN interfaces.

- Implementing Basic NR Physical Layer Procedures
- Designing a Simple NR MAC Scheduler
- Implementing RLC Layer Functionality for Data Segmentation and Reassembly
- Developing PDCP Layer for Header Compression and Encryption
- Establishing RRC Connection Setup and Management

## Unit II

### Chapter No. 4. Core Network Protocols and Technologies

Exploration of core protocols and technologies in 5G NR, including core network architecture, network slicing, and service-based architecture (SBA)

Implementation of key core network protocols using software-defined networking (SDN) principles and open-source tools

- Simulating Basic Network Functionality in 5G Core
- Implementing Authentication and Security Mechanisms

- Setup of Basic Session Management in 5G Core

**Chapter No. 5. Network Slicing, Quality of Service (QoS), and Emerging Trends**

Understanding network slicing concepts and its role in enabling customized services in 5G NR

Implementation of network slicing and QoS management using SDN principles and open-source software platforms. Overview of emerging technologies beyond 5G NR, research challenges, and opportunities

**Unit III****Chapter No. 6. Software-Defined Networking and Virtualization**

Open Flow Concepts: Match fields and actions in OpenFlow protocol

Flow tables and pipeline stages in OpenFlow switches

SDN Controllers: Centralized, distributed, and hybrid SDN controller architectures

Overview of popular SDN controllers: Open Daylight, ONOS, Ryu, Floodlight

SDN Applications: Traffic engineering and load balancing in SDN networks

Network slicing and virtualization for resource allocation

Programmable Data Planes: Overview of programmable data plane technologies such as P4 Benefits and challenges of programmable data planes in SDN

Network Function Virtualization (NFV): Introduction to NFV and its relationship with SDN NFV orchestration and service chaining for network services

**Text Books**

1. "5G NR: The Next Generation Wireless Access Technology" by Erik Dahlman, Stefan Parkvall, Johan Sköld (Academic Press)
2. "Software-Defined Networking: Anatomy of OpenFlow" by Flavio Esposito, William M. Jr. (O'Reilly Media)

**Reference Books:**

1. "5G Mobile Communications" by Mischa Dohler, Afif Osseiran (Wiley)
2. "Software Defined Networks: A Comprehensive Approach" by Paul Goransson, Chuck Black (Morgan Kaufmann)

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                    |                                     | <b>Semester: VII</b>             |
| <b>Course Title: Product and Functional Safety</b>                                                                                                                                                                                                                                                       |                                     | <b>Course Code: 24EECE433</b>    |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                                                                                                                      | <b>Credits: 3</b>                   | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                     | <b>ESA Marks: 50</b>                | <b>Total Marks:100</b>           |
| <b>Teaching Hours: 40Hrs</b>                                                                                                                                                                                                                                                                             | <b>Examination Duration: :3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                            |                                     |                                  |
| <b>Chapter 1: Introduction to Product Safety</b>                                                                                                                                                                                                                                                         |                                     |                                  |
| Introduction, What Is Safety? Product-Safety Management versus Product-Safety Engineering, Product Safety and Product-Safety Engineering, History and Safety, Product Liability                                                                                                                          |                                     |                                  |
| <b>Chapter 2: International Regulations and Global Market Access</b>                                                                                                                                                                                                                                     |                                     |                                  |
| Regional Regulations: How They Differ, CE Marking, NRTLs, Certification Body (CB) Scheme, Product Certification Marks, ISO Registration Process                                                                                                                                                          |                                     |                                  |
| <b>Chapter 3: Product Safety Standards</b>                                                                                                                                                                                                                                                               |                                     |                                  |
| Introduction, Product Safety and Standardization, What Is a Standard? Structure of the Product Safety Standard, Conformity to Product Safety Standards, Objectives for Products Safety Standards, Product Safety Standard Developers.                                                                    |                                     |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                           |                                     |                                  |
| <b>Chapter 4: Hazards, Risks, Accidents, and Outcomes</b>                                                                                                                                                                                                                                                |                                     |                                  |
| Introduction, Recent History of System Safety, Hazards, Risks, Accidents and Outcomes, Risk Estimation, Risk Management                                                                                                                                                                                  |                                     |                                  |
| <b>Chapter 6: Functional Safety in Road Vehicles</b>                                                                                                                                                                                                                                                     |                                     |                                  |
| Introduction, Quality Management System, Process Models, Automotive and Safety life cycles, Hazard Analysis and Risk Assessment according to ISO 26262, Safety Goals, Safety Concepts, Product Development at System and component Level, Verifications and Tests, Safety Validation, Approvals/Releases |                                     |                                  |
| <b>Unit III</b>                                                                                                                                                                                                                                                                                          |                                     |                                  |
| <b>Chapter 5: Methods for Failure Analysis</b>                                                                                                                                                                                                                                                           |                                     |                                  |
| Introduction to analysis, FMEA, FTA, HAZOP, AEA                                                                                                                                                                                                                                                          |                                     |                                  |
| <b>Chapter 7: STPA, SOTIF and ISO</b>                                                                                                                                                                                                                                                                    |                                     |                                  |
| Introduction to STPA, SOTIF, Integration with ISO                                                                                                                                                                                                                                                        |                                     |                                  |
| <b>Text Books</b>                                                                                                                                                                                                                                                                                        |                                     |                                  |
| <ol style="list-style-type: none"> <li>1. “Engineering Ethics and Design for Product Safety”, 1st Edition, ISBN: 9781260460537, McGraw Hill.</li> <li>2. “Electrical product compliance and safety engineering”, Steli L., Constantin B., Jan Swart, Artech House, 2017</li> </ol>                       |                                     |                                  |
| “Functional Safety for Road Vehicles New Challenges and Solutions for E-mobility and Automated                                                                                                                                                                                                           |                                     |                                  |

Driving”, Hans-Leo Ross, Springer International Publishing Switzerland 2016.

**Reference Books:**

1. “The Safety Critical Systems Handbook a Straightforward Guide to Functional Safety: IEC 61508”, David Smith, Kenneth Simpson, Elsevier
  2. “Assessment of Safety Standards for Automotive Electronic Control Systems”, Van Eikema Hommes, Qi D, National Highway Traffic Safety Administration
- “Functional Safety: A Straightforward Guide to Applying IEC 61508 and Related Standards”, David J. Smith and Kenneth G. L. Simpson.

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                     |                                   | <b>Semester: VII</b>             |
| <b>Course Title: Advance IC Packaging</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   | <b>Course Code: 25EECE436</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Credits: 3</b>                 | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>ESA Marks: 33</b>              | <b>Total Marks:100</b>           |
| <b>Teaching Hours: 14Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Examination Duration: 3hrs</b> |                                  |
| <b>Chapter 1: Introduction to Advanced Semiconductor Packaging</b> <ul style="list-style-type: none"><li>• Overview of semiconductor packaging</li><li>• Evolution of packaging technologies</li><li>• Challenges and trends in advanced packaging</li></ul>                                                                                                                                                                                                                              |                                   |                                  |
| <b>Chapter 2: Packaging Materials and Processes</b> <ul style="list-style-type: none"><li>• Materials used in advanced packaging</li><li>• Assembly and packaging processes</li><li>• Flip-chip, wafer-level packaging, and 3D packaging</li><li>• Thermal and reliability considerations</li></ul>                                                                                                                                                                                       |                                   |                                  |
| <b>Chapter 3: System-in-Package (Sip) and Multi-Chip Modules (MCM)</b> <ul style="list-style-type: none"><li>• Introduction to Sip and MCM</li><li>• Design considerations for Sip and MCM</li><li>• Introduction to SerDes, on-die PHYs and signal integrity</li></ul>                                                                                                                                                                                                                   |                                   |                                  |
| <b>Chapter 4: Advanced Interconnect Technologies</b> <ul style="list-style-type: none"><li>• Micro bump and fine-pitch technologies</li><li>• Through-Silicon Via (TSV) and 3D interconnects</li><li>• High-density interconnects (HDI)</li></ul>                                                                                                                                                                                                                                         |                                   |                                  |
| <b>Chapter 5: Layout of Package Substrates (Lecture &amp; Lab)</b> <ul style="list-style-type: none"><li>• Review provided bump-to-ball connectivity data and fill out assigned lab worksheet</li><li>• Open single-die package layout database in a commercial package design tool such as APD+ and explore signal routing and power planes, filling out assigned lab worksheet</li><li>• Given a bump-to-ball map and substrate layer information, implement substrate layout</li></ul> |                                   |                                  |
| <b>Chapter 6: Layout of Silicon Interposers (Lecture &amp; Lab)</b> <ul style="list-style-type: none"><li>• Layout a silicon interposer given a micro bump map for an ASIC and C4 ball assignments using a commercial router such as in Novus</li></ul>                                                                                                                                                                                                                                   |                                   |                                  |
| <b>Reference Books</b> <ol style="list-style-type: none"><li>1. Rao R Tummala, Fundamentals of Device and Systems Packaging, McGraw Hill, 2020.</li><li>2. Glenn R. Blackwell, The Electronics Packaging Handbook, CRC Press, 2017.</li><li>3. Bernard S Matisoff, Handbook of Electronics Packaging Design and Engineering, Springer, 2012.</li><li>4. Rao R Tummala, Fundamentals of Microsystems Packaging, McGraw Hill, 2001.</li></ol>                                               |                                   |                                  |

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| <b>Program: Bachelor of Engineering (Electronics and Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    | <b>Semester: VII Semester</b>    |
| <b>Course Title: Design For Testability</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    | <b>Course Code: 25EVTE402</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Credits: 3</b>                  | <b>Contact Hours: 5 Hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 16 Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Chapter No. 1. Introduction to Design for Testability</b> <ul style="list-style-type: none"> <li>● Overview of the importance of design for testability in modern electronic systems.</li> <li>● Historical context and evolution of testability strategies.</li> <li>● Introduction to key concepts: fault models, testing methodologies, and industry standards <b>(3 Hrs)</b></li> </ul> <b>Chapter No. 2. Built-in Self-Test (BIST) Techniques</b> <ul style="list-style-type: none"> <li>● Principles and implementation of built-in self-test techniques.</li> <li>● Advantages and limitations of BIST in electronic circuit testing.</li> <li>● Lab sessions: Simulations and exercises focusing on BIST. <b>(3 Hrs)</b></li> </ul> <b>Chapter No. 3. Scan Chains and Serial Testing</b> <ul style="list-style-type: none"> <li>● Concept of scan chains and their role in serial testing.</li> <li>● Implementation and optimization of scan chains for improved testability.</li> <li>● Lab sessions: Hands-on exercises with scan chain design and testing <b>(2 Hrs)</b></li> </ul> <b>Chapter No. 4. Fault Modeling and Simulation</b> <ul style="list-style-type: none"> <li>● Development of fault models for electronic circuits.</li> <li>● Utilization of simulation tools to predict and analyze potential faults in a design. and deskew. <b>(2 Hrs)</b></li> </ul> <b>Chapter No. 5. Design for Testability Strategies</b> <ul style="list-style-type: none"> <li>● Exploration of various design for testability strategies.</li> <li>● Case studies: Analyzing successful implementations of design for testability. <b>(1.5 Hrs)</b></li> </ul> <b>Chapter No. 6. Industry Standards in Testability</b> <ul style="list-style-type: none"> <li>● Overview of industry standards related to testability.</li> <li>● Compliance and certification requirements for testable designs. <b>(1.5 Hrs)</b></li> </ul> <b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Tripathi, Suman. Advanced VLSI Design and Testability Issues. CRC Press, 2020.</li> <li>2. Wang, Laung-Terng. VLSI Test Principles and Architectures. Morgan Kaufmann, 2006.</li> <li>3. Huhn, Sebastian. Design for Testability, Debug and Reliability. Springer Nature, 2021.</li> </ol> |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics and Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                           |                                    | <b>Semester: VII</b>             |
| <b>Course Title: Signal and Power Integrity</b>                                                                                                                                                                                                                                                                                                                                                               |                                    | <b>Course Code: 25EECE448</b>    |
| <b>L-T-P: 1-0-2</b>                                                                                                                                                                                                                                                                                                                                                                                           | <b>Credits: 3</b>                  | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                                                                                                                                                                                                                                                                                                                                          | <b>ESA Marks: 33</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 14 Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                 | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                  |
| <b>Chapter No. 1. Introduction to EMC and Signal Integrity</b>                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| <ul style="list-style-type: none"><li>● Overview of Electromagnetic Compatibility (EMC) and Signal Integrity</li><li>● Importance of EMC in electronic systems and its impact on signal integrity <b>(7 Hrs)</b></li></ul>                                                                                                                                                                                    |                                    |                                  |
| <b>Chapter No. 2. EMC Standards and Regulations</b>                                                                                                                                                                                                                                                                                                                                                           |                                    |                                  |
| <ul style="list-style-type: none"><li>● Study of international EMC standards and regulatory requirements</li><li>● Case studies on the consequences of non-compliance <b>(8 Hrs)</b></li></ul>                                                                                                                                                                                                                |                                    |                                  |
| <b>Unit II</b>                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                  |
| <b>Chapter No. 3. Signal Integrity Fundamentals</b>                                                                                                                                                                                                                                                                                                                                                           |                                    |                                  |
| <ul style="list-style-type: none"><li>● Fundamentals of signal integrity in high-speed digital and mixed-signal designs</li><li>● Analysis of transmission line effects, reflections, and signal degradation <b>(7 Hrs)</b></li></ul>                                                                                                                                                                         |                                    |                                  |
| <b>Chapter No. 4. PCB Layout Considerations</b>                                                                                                                                                                                                                                                                                                                                                               |                                    |                                  |
| <ul style="list-style-type: none"><li>● PCB layout techniques for EMC and signal integrity</li><li>● High-speed routing guidelines, power distribution, and grounding strategies <b>(8 Hrs)</b></li></ul>                                                                                                                                                                                                     |                                    |                                  |
| <b>Unit III</b>                                                                                                                                                                                                                                                                                                                                                                                               |                                    |                                  |
| <b>Chapter No. 5. EMI Mitigation Techniques</b>                                                                                                                                                                                                                                                                                                                                                               |                                    |                                  |
| <ul style="list-style-type: none"><li>● Strategies for minimizing electromagnetic interference (EMI)</li><li>● Filtering, shielding, and grounding techniques for EMI mitigation <b>(6 Hrs)</b></li></ul>                                                                                                                                                                                                     |                                    |                                  |
| <b>Chapter No. 6. Simulation Tools for Signal Integrity</b>                                                                                                                                                                                                                                                                                                                                                   |                                    |                                  |
| <ul style="list-style-type: none"><li>● Introduction to simulation tools for signal integrity analysis</li><li>● Hands-on exercises using simulation software to predict and optimize signal integrity. <b>(6 Hrs)</b></li></ul>                                                                                                                                                                              |                                    |                                  |
| <b>References:</b>                                                                                                                                                                                                                                                                                                                                                                                            |                                    |                                  |
| <ol style="list-style-type: none"><li>1. Bogatin, Eric. Signal and Power Integrity - Simplified. Prentice Hall, 2017.</li><li>2. Montrose, Mark. EMC and the Printed Circuit Board. John Wiley &amp; Sons, 2004.</li><li>3. Christopoulos, Christos. Principles and Techniques of Electromagnetic Compatibility. CRC Press, 2018.</li><li>4. Russ, Samuel. Signal Integrity. Springer Nature, 2022.</li></ol> |                                    |                                  |

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## 8<sup>th</sup> Semester Electives

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                  | <b>Semester: VIII</b>            |
| <b>Course Title: OOPS using C++</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                  | <b>Course Code:25EECE421</b>     |
| <b>L-T-P: 2-0-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Credits:3</b>                 | <b>Contact Hours: 4 hrs/week</b> |
| <b>ISA Marks:67</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>ESA Marks:33</b>              | <b>Total Marks:100</b>           |
| <b>Teaching Hours: 30Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Examination Duration:2Hrs</b> |                                  |
| <b>UNIT I</b><br><b>Chapter 1: Fundamental concepts of object-oriented programming:</b><br>Introduction to object-oriented programming, Programming Basics (keywords, identifiers, variables, operators, classes, objects), Arrays and Strings Functions/ methods (parameter passing techniques)<br><b>Chapter 2: OOPs Concepts:</b><br>Overview of OOPs Principles, Introduction to classes & objects, Creation & destruction of objects, Data Members, Member Functions, Constructor & Destructor, Static class member, Friend class and functions, Namespace |                                  |                                  |
| <b>UNIT II</b><br><b>Chapter 3: Inheritance:</b><br>Introduction and benefits, Abstract class, Aggregation: classes within classes, Access Specifier, Base and Derived class Constructors, Types of Inheritance, Function overriding<br><b>Chapter 4: Polymorphism:</b><br>Virtual functions, Friend functions, static functions, this pointer                                                                                                                                                                                                                  |                                  |                                  |
| <b>Unit III</b><br><b>Chapter 5: Exception Handling:</b><br>Introduction to Exception, Benefits of Exception handling, Try and catch block, throw statement, pre-defined exceptions in C++, Writing custom Exception class<br><b>Chapter 6: I/O Streams:</b><br>C++ Class Hierarchy, File Stream, Text File Handling, Binary File Handling<br>Error handling during file operations, Overloading << and >> operators                                                                                                                                            |                                  |                                  |
| <b>Textbook:</b><br>1. Robert Lafore, "Object oriented programming in C++", 4 <sup>th</sup> Edition, Pearson education, 2009. Neural Networks and Deep Learning by Michael Nielsen.                                                                                                                                                                                                                                                                                                                                                                             |                                  |                                  |
| <b>Reference books:</b><br>1. Lippman S B, Lajorie J, Moo B E, C++ Primer, 5ed, Addison Wesley, 2013.<br>2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill                                                                                                                                                                                                                                                                                                                                                                          |                                  |                                  |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics and Communication Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    | <b>Semester: VIII</b>            |
| <b>Course Title: Multisensor Data fusion</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    | <b>Course Code: 25EECE453</b>    |
| <b>L-T-P: 3-0-0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Credits: 3</b>                  | <b>Contact Hours: 3 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 44 Hrs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Examination Duration: 3 Hrs</b> |                                  |
| <b>Unit I</b><br><b>Chapter 1: Fundamentals of multi-sensor data Fusion system</b><br>Synergy, Multi sensor data fusion strategies, formal framework, catastrophic fusion, fusion applications.<br>06 Hrs<br><b>Chapter 2: Sensor Models</b><br>Smart /logical sensor, interface file system, sensor observation, sensor characteristics, sensor model.<br>06 Hrs.<br><b>Chapter 3: Architecture and Data representation formats</b><br>Fusion node, simple fusion network, network topology, Spatial-temporal transformation, geographical information system, common representation format, subspace methods, multiple training sets.<br>08 Hrs. |                                    |                                  |
| <b>Unit II</b><br><b>Chapter 4: Spatial alignment</b><br>Image registration, resample/interpolation, pair wise transformation, image fusion 04 Hrs.<br><b>Chapter 5: Temporal alignment</b><br>Dynamic time warping, dynamic programming, video compression. 06 Hrs.<br><b>Chapter 6: Semantic Alignment</b><br>Assignment Matrix, Clustering Algorithms, Cluster Ensembles 04 Hrs.                                                                                                                                                                                                                                                                |                                    |                                  |
| <b>Unit III</b><br><b>Chapter 7: Bayesian Inference</b><br>Bayesian analysis, probability model, Posteriori distribution, Model selection, computation.<br>06 Hrs.<br><b>Chapter 8: Sensor management</b><br>Hierarchical classification, sensor management techniques 04 Hrs.                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                  |
| <b>Textbook:</b><br><b>1. H.B.Mitchell, , Multi Sensor Data Fusion, An Introduction, II, springer, 2007</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                  |

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| <b>Program: Bachelor of Engineering (Electronics and Communication Engineering)</b> |                                   | <b>Semester: VIII</b>            |
| <b>Course Title: Advanced DFT for ASIC Design</b>                                   |                                   | <b>Course Code: 25EECE449</b>    |
| <b>L-T-P: 1-0-2</b>                                                                 | <b>Credits: 3</b>                 | <b>Contact Hours: 5 hrs/week</b> |
| <b>ISA Marks: 67</b>                                                                | <b>ESA Marks: 33</b>              | <b>Total Marks: 100</b>          |
| <b>Teaching Hours: 16Hrs</b>                                                        | <b>Examination Duration: 3Hrs</b> |                                  |

#### **Week 1: DFT Foundations and Modern Challenges**

##### **Lectures:**

- Review of basic DFT concepts and fundamentals
- Advancements in modern ASIC testing requirements
- Test economics and the impact of DFT on product quality
- Current industry standards and methodologies

##### **Lab:**

- DFT tool setup and environment configuration
- Analysis of ASIC test coverage metrics

##### **Assignment:**

- Case study analysis of DFT implementations in commercial ASICs

#### **Week 2: Advanced Scan Architectures**

##### **Lectures:**

- Multi-mode scan architectures
- Scan compression techniques
- On-chip clock control for scan testing
- Low-power scan techniques

##### **Lab:**

- Implementation of compressed scan chains using industry tools
- Analysis of test pattern count reduction

##### **Assignment:**

- Design and implementation of a scan compression architecture

#### **Week 3: At-Speed Testing Methodologies**

##### **Lectures:**

- Clock domain crossing test considerations

- Launch-on-shift vs. launch-on-capture techniques
- Multiple clock domain test strategies
- Path delay fault testing methods

**Lab:**

- Setting up at-speed test for a sample design
- Transition and path delay fault ATPG

**Assignment:**

- Analysis and improvement of at-speed test coverage for a given design

**Week 4: Memory Testing and BIST**

**Lectures:**

- Memory fault models and test algorithms
- Memory BIST architectures
- Repair strategies and redundancy analysis
- Memory test interfaces and standards

**Lab:**

- Memory BIST implementation and simulation
- Analysis of memory test coverage

**Assignment:**

- Design of a memory BIST solution for an embedded SRAM array

**Week 5: Boundary Scan and IEEE 1149.x Standards**

**Lectures:**

- IEEE 1149.1 (JTAG) standard in depth
- IEEE 1149.6 for AC-coupled signals
- IEEE 1687 (IJTAG) for instrument access
- Boundary scan test pattern generation

**Lab:**

- Implementation of JTAG interface and boundary scan cells
- IJTAG network design and implementation

**Assignment:**

- Development of a comprehensive boundary scan solution for a complex ASIC

**Week 6: DFT for Mixed-Signal ICs****Lectures:**

- ADC/DAC testing methodologies
- Analog test access mechanisms
- IEEE 1149.4 and mixed-signal test bus
- Loopback testing strategies

**Lab:**

- Design of test structures for mixed-signal components
- Mixed-signal DFT insertion and analysis

**Assignment:**

- Development of a test strategy for a mixed-signal subsystem

**Week 7: Midterm Project Week****Project:**

- Comprehensive DFT implementation for a medium-complexity ASIC
- Test strategy documentation and presentation
- Coverage analysis and optimization

**Week 8: Advanced ATPG and Fault Models****Lectures:**

- Beyond stuck-at fault models
- Cell-aware fault models
- Small delay defect testing
- Advanced ATPG algorithms and optimizations

**Lab:**

- Implementation of cell-aware and advanced fault models
- Pattern generation for multiple fault models

**Assignment:**

- Analysis of test coverage improvement using advanced fault models

**Week 9: DFT for Low Power Designs****Lectures:**

- Power-aware test strategies
- DFT for power gating architectures
- Testing for power domain isolation
- IEEE 1801 (UPF) integration with DFT

**Lab:**

- Implementation of power-aware scan insertion
- Analysis of test power consumption

**Assignment:**

- Development of a low-power test strategy for a multi-power domain design

**Week 10: DFT for Advanced SoCs and Multi-Core Designs****Lectures:**

- Hierarchical test strategies
- DFT for NoC (Network on Chip) architectures
- Test scheduling and optimization
- Reuse of IP test structures

**Lab:**

- Implementation of hierarchical test architecture
- Integration of IP-level test structures

**Assignment:**

- Development of a test strategy for a complex SoC with multiple IP blocks

**Week 11: DFT for Emerging Technologies and Final Project****Lectures:**

- DFT for 2.5D/3D ICs
- Machine learning applications in testing
- DFT for security (secure scan, anti-tampering)
- Future trends in ASIC testing

**Final Project Presentation:**

- Comprehensive DFT implementation for a complex ASIC/SoC
- Test coverage analysis and optimization
- Test time and cost evaluation
- Presentation of results and design decisions

**Textbook:**

1. "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits" by M. Bushnell and V. Agrawal
2. "VLSI Test Principles and Architectures" by L.T. Wang, C.W. Wu, and X. Wen
3. Selected IEEE papers on advanced DFT methodologies
4. Industry white papers on modern DFT implementation

**Referenc Tools:**

- Mentor Graphics Tessent



## Swayam Courses

|                                                                                       |                                  |                                 |
|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Phase-locked loops (Swayam)</b>                                      |                                  | <b>Course Code:22EECE432</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: VLSI Design Flow: RTL to GDS (Swayam)</b>                            |                                  | <b>Course Code:23EECE435</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Cyber Security and Privacy (Swayam)</b>                              |                                  | <b>Course Code:23EECE439</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  |
| <b>Course Title: Introduction To Algorithms And Analysis (Swayam)</b>                 |                                  |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |

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|---------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>             |
| <b>Course Title: Cryptography And Network Security (Swayam)</b>                       |                                  | <b>Course Code:22EECE431</b>     |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours: 6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>           |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                  |



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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Cloud Computing (Swayam)</b>                                         |                                  | <b>Course Code:22EECE444</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|--------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>            |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Fabrication Techniques for MEMs-based Sensors: Clinical Perspective(Swayam)</b> |                                  | <b>Course Code:25EECE430</b>    |
| <b>L-T-P: 0-0-3</b>                                                                              | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                             | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                                      | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Computer Vision (Swayam)</b>                                         |                                  | <b>Course Code:25EECE443</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: C-Based VLSI Design(Swayam)</b>                                      |                                  | <b>Course Code:23EECE436</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Fundamentals of Micro and Nanofabrication(Swayam)</b>                |                                  | <b>Course Code:23EECE438</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Software Testing(Swayam)</b>                                         |                                  | <b>Course Code:25EECE446</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b>                          |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning(Swayam)</b> |                                  | <b>Course Code:23EECE437</b>    |
| <b>L-T-P: 0-0-3</b>                                                                                            | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                                           | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                                                    | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: Introduction to Adaptive Signal Processing(Swayam)</b>               |                                  | <b>Course Code:25EECE448</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |

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|---------------------------------------------------------------------------------------|----------------------------------|---------------------------------|
| <b>Program: Bachelor of Engineering (Electronics &amp; Communication Engineering)</b> |                                  | <b>Semester: VII</b>            |
| <b>Course Title: RFIC Design(Swayam)</b>                                              |                                  | <b>Course Code:25EECE449</b>    |
| <b>L-T-P: 0-0-3</b>                                                                   | <b>Credits:3</b>                 | <b>Contact Hours:6 hrs/week</b> |
| <b>ISA Marks:100</b>                                                                  | <b>ESA Marks:</b>                | <b>Total Marks:100</b>          |
| <b>Teaching Hours:42Hrs</b>                                                           | <b>Examination Duration:3Hrs</b> |                                 |



|                                                  |                             |                            |
|--------------------------------------------------|-----------------------------|----------------------------|
| Program: Electronics & Communication Engineering |                             | Semester: VIII             |
| Course Title: Capstone Project                   |                             | Course Code: 20EECW402     |
| L-T-P: 0-0-11                                    | Credits: 11                 | Contact Hours: 22 hrs/week |
| ISA Marks: 50                                    | ESA Marks: 50               | Total Marks: 100           |
| Teaching Hours: --                               | Examination Duration: 3 Hrs |                            |

- Smart City
- Connected Cars
- Home Automation
- Health care
- Smart energy
- Automation of Agriculture

#### Guide lines for selection of a project:

- The project needs to encompass the concepts learnt in the previous semesters, so that the student will learn to integrate, the knowledge base acquired to provide a solution to the defined problem statement of the project work.
- Student can select a project which leads to a product or model or prototype.
- Time plan: Effort to do the project should be between 60-70 Hrs per team, which includes self-study of an individual member (80-100 Hrs) and team work (40-50hrs).
- Learning overhead should be 20-25% of total project development time.

#### Criteria for group formation:

- 3-4 students in a team.
- Role of teammates: Team lead and members.

#### Allocation of Guides and Mentors for the projects:

Every Project batch will be allocated with one faculty.

#### Details of the project batches:

- Number of faculty - members: 50
- Number of students: 3-4 students in a team.

#### Role of a Guide

The primary responsibility of the guide is to help students to understand the meaning and need of various stages in the implementation of the project. At every stage of the project development, guide should help towards its successful completion as per the predefined standards.

#### How student should carry out a project:

- Define the problem.
- Specify the requirements.
- Specify the design in the understandable form (Block Diagram, Flowchart, Algorithm, etc).
- Analyze the design and identify hardware and software components separately.
- Select appropriate simulation tool and development board for the design.
- Implement the design.
- Optimize the design and generate the results.

- Result representation and analysis.
- Prepare a document and presentation.

#### **Report Writing**

- The format for report writing should be downloaded from <ftp://10.3.0.3/projects>
- The report needs to be shown to guide and committee for each review.
- 

#### **Evaluation Scheme**

- Internal semester assessment (ISA)
- Evaluation is done based on the evaluation rubrics given in Table 1
- Project shall be reviewed and evaluated by the concerned Guide for 50% of the marks.
- Project shall be evaluated by the review committee for 50% of the marks.

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------|
| <b>Course Title: Internship- Training</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    | <b>Course Code: 18EECI493</b>     |
| <b>L-T-P: 0-0-6</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Credits: 6</b>                  | <b>Contact Hours: 12 hrs/week</b> |
| <b>ISA Marks: 50</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>           |
| <b>Teaching Hours: --</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Examination Duration: 3 Hrs</b> |                                   |
| <b>Evaluation parameters for Internship Training</b> <ul style="list-style-type: none"><li>▪ Initiative and creativity</li><li>▪ Adaptation capacity</li><li>▪ Commitment and perseverance</li><li>▪ Independence</li><li>▪ Handling supervisor's comments and development skills</li><li>▪ Time management</li><li>▪ Formulation goals, framework project</li><li>▪ Theoretical underpinning, use of literature</li><li>▪ Use of methods and processing data</li><li>▪ Reflection on results</li><li>▪ Conclusions and discussion</li><li>▪ Presentation skills</li></ul> |                                    |                                   |

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|-------------------------------------------------------------|------------------------------------|-----------------------------------|
| <b>Program: Electronics &amp; Communication Engineering</b> |                                    | <b>Semester: VIII</b>             |
| <b>Course Title: Internship- Project</b>                    |                                    | <b>Course Code: 20EECW494</b>     |
| <b>L-T-P: 0-0-11</b>                                        | <b>Credits: 11</b>                 | <b>Contact Hours: 22 hrs/week</b> |
| <b>ISA Marks: 50</b>                                        | <b>ESA Marks: 50</b>               | <b>Total Marks: 100</b>           |
| <b>Teaching Hours: --</b>                                   | <b>Examination Duration: 3 Hrs</b> |                                   |

**Evaluation parameters for Internship Project**

- Initiative and creativity
- Adaptation capacity
- Commitment and perseverance
- Independence
- Handling supervisor's comments and development skills
- Time management
- Formulation goals, framework project
- Theoretical underpinning, use of literature
- Use of methods and processing data
- Reflection on results
- Conclusions and discussion
- Presentation skills

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