

BVVS

**Basaveshwar Engineering College, Bagalkote**

**Department of Electronics and Communication Engineering**

**Vision, Mission Statements and Values**

**Vision**

To achieve excellence in electronics and communication engineering through quality education and research for developing competent professionals.

**Mission**

1. Foster a dynamic teaching and learning process.
2. Encourage research through innovation and collaboration.
3. Imbibe moral, ethical values and social responsibilities.

**Values**

The values of the department are

1. Work is Worship
2. Ethics and Integrity
3. Empathy and Compassion
4. Indian Ethos
5. Mutual Respect

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**Basaveshwar Engineering College, Bagalkote**

**Department of Electronics and Communication Engineering**

**SWOC Analysis**

**S:Strength:**

1. Infrastructure
  - (i.) ICT enabled classrooms/seminar hall with good ambience.
  - (ii.) Well equipped laboratories to cater curriculum requirements.
  - (iii.) Department library with good number of titles and volumes.
  - (iv.) Scope for academic extension programmes.
2. Faculty
  - (i.) 75% of faculty with Ph.D.
  - (ii.) Faculty with minimum of 12 years teaching experience.
  - (iii.) Faculty retention ratio is 100 %.
3. Students
  - (i.) Students with academic and competitive bent of mind.
  - (ii.) 75% of the students are placed in reputed industries.
  - (iii.) 10% to 15% of the students are registering for B.E. Honours Degree.
4. Curriculum
  - (i.) Research and industry oriented adaptive curriculum.
  - (ii.) Curriculum with integrated courses.
5. Alumni
  - (i.) Alumni works in reputed organizations across the world.
  - (ii.) Alumni interactions with students and faculty to bridge the gap between campus and corporate.

**W:Weakness:**

1. IPR competencies are inadequate.
2. Relatively less number of memberships in professional bodies.
3. Limited collaborative activities.
4. Less number of inter-disciplinary courses and projects.
5. Less number of industry supported laboratories/courses.
6. Inadequate number of funded projects.
7. Less scope for co-curricular and cultural activities.

## **O:Opportunities:**

1. Establishment of Distant Learning Center (DLC) using existing resources.
2. Participation in collaborative projects/ research work with allied institutions.
3. Fostering alumni participation in academics and placement activities.
4. Establishment of Skilling Centers for students.
5. Faculty exchange programs with academia and industry.
6. Organizing conferences.
7. Facilitating incubation centers for alumni.
8. Scope for academic extension programmes
9. Training on computer usage/ programming languages for general public.
10. Enhancing consultancy activities.

## **C:Challenges:**

1. To incorporate experiential teaching learning process.
2. Adapting curriculum to future industry needs.
3. Fostering collaboration to enhance research, innovation and entrepreneurship activities.
4. Attracting diversified students.
5. Strategies to strengthen the placement activities for higher packages and core companies.
6. Secure additional research grants and consultancy opportunities.
7. Enhance quality publications and file patents.

## **Programme Outcomes**

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- a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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### **Programme Specific Outcomes (PSOs)**

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1. Analyze and design systems for electronics, communication, and signal processing applications.
2. Use domain specific tools for design, analysis, synthesis, and validation of VLSI and embedded systems
3. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications

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### **Programme Educational Objectives (PEOs)**

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1. Prepare students with thorough understanding of science, engineering, and technology to develop innovative solutions for challenges in industry and society
  2. Enable students to excel in academia, industry, entrepreneurship and engage in research and lifelong learning
  3. Train students to work effectively as individuals and in multidisciplinary environments with high integrity, ethics, human values and societal responsibility
  4. Impart skills to the students to design, develop and provide novel solutions for Electronics and Communication engineering problems
  5. Equip students with strong leadership, communication, and teamwork skills to succeed in dynamic professional environments and contribute meaningfully to the global challenges
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**Basaveshwar Engineering College (Autonomous), Bagalkote**

**Department of Electronics and Communication Engineering**

**Credit split-up for Undergraduate Program**

**Break-up of Credits for B.E (Common to all Branches)**

**Applicable to 2021-22 (Regular) and 2022-23 (Lateral Entry) Batch - 160 credits**

| Sem.        | BSC       | ESC       | HSSM      | AEC                      | PCC       | PEC       | OEC       | Proj.     | Int.      | Tech. Sem. | Mand. (UHV) | Total      |
|-------------|-----------|-----------|-----------|--------------------------|-----------|-----------|-----------|-----------|-----------|------------|-------------|------------|
| 1.          | 07        | 10        | 02        | 01                       |           |           |           |           |           |            |             | 20         |
| 2.          | 07        | 09        | 02        | 02                       |           |           |           |           |           |            |             | 20         |
| 3.          | 03        |           | 01        | 01 (Dept.)               | 14        |           |           |           |           |            | 01          | 20         |
| 4.          | 03        |           | 01        |                          | 14        |           |           |           | 02        |            |             | 20         |
| 5.          |           |           | 01        | 02 (SS)                  | 10        | 03        | 03        |           | 03        |            |             | 22         |
| 6.          | 03        |           |           |                          | 08        | 03        | 06        | 02        |           |            |             | 22         |
| 7.          |           |           | 03        |                          | 03        | 06        |           | 08        |           |            |             | 20         |
| 8.          |           |           |           | 03 (MOOCS)<br>02 (Dept.) |           |           |           |           | 10        | 01         |             | 16         |
| <b>Tot.</b> | <b>23</b> | <b>19</b> | <b>10</b> | <b>11</b>                | <b>49</b> | <b>12</b> | <b>09</b> | <b>10</b> | <b>15</b> | <b>01</b>  | <b>01</b>   | <b>160</b> |

**I Semester B.E. (Common to all Branches)**

| Sl. No       | Category | Subject Code | Subject Title                    | Credits   | HOURS/ WEEK |          |          | EXAMINATION MARKS |            |            |
|--------------|----------|--------------|----------------------------------|-----------|-------------|----------|----------|-------------------|------------|------------|
|              |          |              |                                  |           | L           | T        | P        | CIE               | SEE        | Total      |
| 1.           | BSC      | 21UMA101C    | Engineering Mathematics - I      | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 2.           | BSC      | 21UPH102C    | Engineering Physics              | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 3.           | ESC      | 21UEE105C    | Basic Electrical Engineering     | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 4.           | ESC      | 22UEC104C    | Basic Electronics                | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 5.           | ESC      | 21UCS103C    | Principles of Programming with C | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 6.           | BSC      | 21UPH108L    | Engineering Physics Laboratory   | 01        | 0           | 0        | 2        | 50                | 50         | 100        |
| 7.           | ESC      | 21UCS109L    | Programming Practice using C     | 01        | 0           | 0        | 2        | 50                | 50         | 100        |
| 8.           | HSSM     | 21UHS106C    | Communicative English            | 02        | 2           | 0        | 0        | 50                | 50         | 100        |
| 9.           | AEC      | 21UHS107C    | Scientific Foundations of Health | 01        | 2           | 0        | 0        | 50                | 50         | 100        |
| <b>Total</b> |          |              |                                  | <b>20</b> | <b>18</b>   | <b>0</b> | <b>4</b> | <b>450</b>        | <b>450</b> | <b>900</b> |

**II Semester B.E. (Common to all Branches)**

| Sl. No       | Category | Subject Code | Subject Title                          | Credits   | HOURS/ WEEK |          |          | EXAMINATION MARKS |            |            |
|--------------|----------|--------------|--|-----------|-------------|----------|----------|-------------------|------------|------------|
|              |          |              |  |           | L           | T        | P        | CIE               | SEE        | Total      |
| 1.           | BSC      | 21UMA201C    | Engineering Mathematics - II           | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 2.           | BSC      | 21UCH210C    | Engineering Chemistry                  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 3.           | ESC      | 21UME212C    | Elements of Mechanical Engineering     | 03        | 2           | 2        | 0        | 50                | 50         | 100        |
| 4.           | ESC      | 21UCV211C    | Engineering Mechanics                  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 5.           | ESC      | 21UME213L    | Computer Aided Engineering Drawing     | 03        | 2           | 0        | 2        | 50                | 50         | 100        |
| 6.           | BSC      | 21UCH214L    | Engineering Chemistry Laboratory       | 01        | 0           | 0        | 2        | 50                | 50         | 100        |
| 7.           | HSSM     | 21UHS206C    | Professional Writing Skills in English | 02        | 2           | 0        | 0        | 50                | 50         | 100        |
| 8.           | AEC      | 21UHS215C    | Innovation and Design Thinking         | 02        | 1           | 0        | 2        | 50                | 50         | 100        |
| <b>Total</b> |          |              |  | <b>20</b> | <b>16</b>   | <b>2</b> | <b>6</b> | <b>400</b>        | <b>400</b> | <b>800</b> |



**III Semester B.E. (E & CE)**

| Sl. No       | Category | Subject Code | Subject Title                                | Credits   | HOURS/<br>WEEK          |          |          | EXAMINATION<br>MARKS      |                           |                             |
|--------------|----------|--------------|--|-----------|-------------------------|----------|----------|---------------------------|---------------------------|-----------------------------|
|              |          |              |  |           | L                       | T        | P        | CIE                       | SEE                       | Total                       |
| 1.           | BSC      | 21UMA301C    | Numerical Techniques and Integral Transforms | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                         |
| 2.           | PCC      | 21UEC302C    | Electronic Devices and Circuits              | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                         |
| 3.           | PCC      | 21UEC303C    | Digital Electronics and Logic Design         | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                         |
| 4.           | PCC      | 21UEC304C    | Network Analysis                             | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                         |
| 5.           | PCC      | 21UEC305C    | Data Structures using "C"                    | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                         |
| 6.           | PCC      | 21UEC306L    | Electronic Devices and Circuits Laboratory   | 01        | 0                       | 0        | 3        | 50                        | 50                        | 100                         |
| 7.           | PCC      | 21UEC307L    | Digital Electronics Laboratory               | 01        | 0                       | 0        | 3        | 50                        | 50                        | 100                         |
| 8.           | AEC      | 21UEC308C    | Higher Programming Paradigm                  | 01        | 0                       | 0        | 3        | 50                        | 50                        | 100                         |
| 9            | UHV      | 21UHS324C    | Universal Human Values - II                  | 01        | 1                       | 0        | 0        | 50                        | 50                        | 100                         |
| 10           | HSSM     | 21UHS321C    | Constitution of India                        | 01        | 1                       | 0        | 0        | 50                        | 50                        | 100                         |
| 11           | PCC      | 21UMA300M    | Bridge Course Mathematics – I*               | --        | 3*                      | 0        | 0        | 50*                       | 50*                       | 100*                        |
| <b>Total</b> |          |              |  | <b>20</b> | <b>17</b><br><b>20*</b> | <b>0</b> | <b>9</b> | <b>500</b><br><b>550*</b> | <b>500</b><br><b>550*</b> | <b>1000</b><br><b>1100*</b> |

**IV Semester B.E. (E & CE)**

| Sl. No       | Category | Subject Code           | Subject Title                            | Credits   | HOURS/ WEEK             |          |          | EXAMINATION MARKS         |                           |                           |
|--------------|----------|------------------------|--|-----------|-------------------------|----------|----------|---------------------------|---------------------------|---------------------------|
|              |          |                        |  |           | L                       | T        | P        | CIE                       | SEE                       | Total                     |
| 1.           | BSC      | 21UMA401C              | Statistics and Probability Distributions | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                       |
| 2.           | PCC      | 21UEC402C              | Signals and Systems                      | 03        | 2                       | 2        | 0        | 50                        | 50                        | 100                       |
| 3.           | PCC      | 21UEC403C              | Linear Integrated Circuits               | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                       |
| 4.           | PCC      | 21UEC404C              | Analog and Digital Communication         | 03        | 3                       | 0        | 0        | 50                        | 50                        | 100                       |
| 5.           | PCC      | 21UEC405C              | Microcontrollers                         | 03        | 3                       | 0        | 0        |                           |                           |                           |
| 6.           | PCC      | 21UEC406L              | Communication Engineering Laboratory     | 01        | 0                       | 0        | 3        | 50                        | 50                        | 100                       |
| 7.           | PCC      | 21UEC407L              | Microcontroller Laboratory               | 01        | 0                       | 0        | 3        | 50                        | 50                        | 100                       |
| 8.           | INT      | 21UEC408I              | Internship - I                           | 02        | --                      | --       | --       | 100                       | 00                        | 100                       |
| 9.           | HSSM     | 21UHS422C<br>21UHS423C | Sanskrutika Kannada<br>Balake Kannada    | 01        | 1                       | 0        | 0        | 50                        | 50                        | 100                       |
| 10.          | PCC      | 21UMA400M              | Bridge Course Mathematics – II*          | --        | 3*                      | 0        | 0        | 50*                       | 50*                       | 100*                      |
| <b>Total</b> |          |                        |  | <b>20</b> | <b>15</b><br><b>18*</b> | <b>2</b> | <b>6</b> | <b>400</b><br><b>450*</b> | <b>400</b><br><b>450*</b> | <b>800</b><br><b>900*</b> |

**V Semester B.E. (E & CE)**

| Sl. No       | Category | Subject Code                        | Subject Title  | Credits   | HOURS/ WEEK |          |          | EXAMINATION MARKS |            |            |
|--------------|----------|-------------------------------------|--|-----------|-------------|----------|----------|-------------------|------------|------------|
|              |          |                                     |  |           | L           | T        | P        | CIE               | SEE        | Total      |
| 1            | PCC      | 21UEC501C                           | Digital Signal Processing  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 2            | PCC      | 21UEC502C                           | Control Engineering  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 3            | PCC      | 21UEC503C                           | CMOS Digital VLSI Design   | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
|              | PCC      | 21UEC504L                           | CMOS Digital VLSI Laboratory   | 01        | 0           | 0        | 3        | 50                | 50         | 100        |
| 5            | PEC      | 21UEC505E<br>21UEC506E<br>21UEC507E | 1) Java Programming<br>2) Digital System Design using Verilog<br>3) Mobile Communication | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 6            | OEC1     | 21UEC535n<br>21UEC532N              | 1) Communication Systems<br>2) Digital Electronics and Microcontrollers                  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 7            | INT      | 21UEC510I                           | Internship – II  | 03        | -           | -        | -        | 70                | 30         | 100        |
| 8            | HSSM     | 21UBT523C                           | Environmental Studies  | 01        | 1           | 0        | 0        | 50                | 50         | 100        |
| 9            | AEC      | 21UHS521C                           | Quantitative Aptitude and Professional Skills  | 02        | 2           | 0        | 0        | 50                | 50         | 100        |
| <b>Total</b> |          |                                     |  | <b>22</b> | <b>17</b>   | <b>2</b> | <b>5</b> | <b>450</b>        | <b>450</b> | <b>900</b> |

**VI Semester B.E. (E & CE)**

| Sl. No       | Category | Subject Code  | Subject Title   | Credits   | HOURS/<br>WEEK |          |          | EXAMINATION<br>MARKS |            |            |
|--------------|----------|---|---|-----------|----------------|----------|----------|----------------------|------------|------------|
|              |          |   |   |           | L              | T        | P        | CIE                  | SEE        | Total      |
| 1.           | BSC      | 21UEC601C   | Information Theory and Coding   | 03        | 3              | 0        | 0        | 50                   | 50         | 100        |
| 2.           | PCC      | 21UEC602C   | Electromagnetic Theory  | 03        | 3              | 0        | 0        | 50                   | 50         | 100        |
| 3.           | PCC      | 21UEC603C   | Computer Networks   | 03        | 3              | 0        | 0        | 50                   | 50         | 100        |
|              | PCC      | 21UEC604L   | Computer Networks Laboratory  | 01        | 0              | 0        | 3        | 50                   | 50         | 100        |
| 5            | PCC      | 21UEC605L   | Advanced Communication Laboratory   | 01        | 0              | 0        | 3        | 50                   | 50         | 100        |
| 6            | PEC      | 21UEC606E<br>21UEC607E<br>21UEC608E<br>21UEC609E<br>21UEC610E | 1) Biomedical Signal Processing<br>2) Computer Organization<br>3) Image Processing<br>4) Embedded Systems<br>5) Wireless Networks | 03        | 3              | 0        | 0        | 50                   | 50         | 100        |
| 7            | OEC2     | 21UEC611N<br>21UEC612N  | 1) Sensor Technology<br>2) Image Processing<br>3) Sensors and Actuators   | 03        | 3              | 0        | 0        | 50                   | 50         | 100        |
|              | OEC3     | 21UEC613N<br>21UEC614N  | 1) Modeling and Simulation of engineering Systems<br>2) Nanotechnology  | 03        | 3              | 0        | 0        | 50                   | 50         | 100        |
| 9            | MP       | 21UEC613P   | Mini Project  | 02        | -              | -        | -        | 50                   | 50         | 100        |
| <b>Total</b> |          |   |   | <b>22</b> | <b>15</b>      | <b>0</b> | <b>6</b> | <b>400</b>           | <b>400</b> | <b>800</b> |

VII/VIII Semester B.E. (E & CE), Group – 1\*

| Sl. No       | Category | Subject Code  | Subject Title   | Credits   | HOURS/ WEEK |          |          | EXAMINATION MARKS |            |            |
|--------------|----------|---|---|-----------|-------------|----------|----------|-------------------|------------|------------|
|              |          |   |   |           | L           | T        | P        | CIE               | SEE        | Total      |
| 1.           | PCC      | 21UEC701C   | <b>Microwaves and Antennas</b>  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 2.           | PEC      | 21UEC702E<br>21UEC703E<br>21UEC704E<br>21UEC718E<br>21UEC706E<br>21UEC707E<br>21UEC716E | <b>1) Multimedia Communication<br/>2) Machine Learning<br/>3) Micro Electro Mechanical Systems<br/>4) VLSI Testing<br/>5) Advanced Tools for VLSI Design<br/>6) Speech Signal Processing<br/>7) IoT(Hardware Orientation)</b> | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 3            | PEC      | 21UEC717E<br>21UEC710E<br>21UEC712E<br>21UEC713E<br>21UEC714E<br>21UEC715E<br>21UEC705E | <b>1) Multi-rate Signal Processing<br/>2) Wavelets<br/>3) Operating Systems<br/>4) ANN(Artificial Neural Networks)<br/>5) Cryptography and Network Security<br/>6) IC Technology<br/>7) Satellite Communications</b>          | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| 5.           | Project  | 21UEC708P   | <b>Project Work</b>   | 08        | --          | --       | --       | 50                | 50         | 100        |
| 7            | HSSM     | 21UEC709C   | <b>Human Resource and Management</b>  | 03        | 3           | 0        | 0        | 50                | 50         | 100        |
| <b>Total</b> |          |   |   | <b>20</b> | <b>12</b>   | <b>0</b> | <b>0</b> | <b>250</b>        | <b>250</b> | <b>500</b> |

- 7<sup>th</sup> and 8<sup>th</sup> semesters are swapped between group 1 and group 2 students
- \* Offered between 3<sup>rd</sup> to 6<sup>th</sup> semester

| Sl. No       | Category | Subject Code | Subject Title        | Credits   | HOURS/ WEEK |   |   | EXAMINATION MARKS |            |            |
|--------------|----------|--------------|----------------------|-----------|-------------|---|---|-------------------|------------|------------|
|              |          |              |                      |           | L           | T | P | CIE               | SEE        | Total      |
| 1.           | AEC      | 21UECXXXX    | MOOCs*               | 03        | -           | - | - | -                 | -          | -          |
| 2.           | AEC      | 21UEC802C    | Research Methodology | 02        | -           | - | - | 50                | 50         | 100        |
| 3.           | Seminar  | 21UEC803S    | Technical Seminar    | 01        | -           | - | - | 50                | 50         | 100        |
| 4.           | INT      | 21UEC804T    | Internship - III     | 10        | -           | - | - | 50                | 50         | 100        |
| <b>Total</b> |          |              |                      | <b>16</b> | -           | - | - | <b>150</b>        | <b>150</b> | <b>300</b> |

**Syllabus for  
B.E. I & II – Semester  
(For students admitted to I year in 2021-22)**

|                        |                          |                                  |
|------------------------|--------------------------|----------------------------------|
| <b>21UEC104C</b>       | <b>Basic Electronics</b> | <b>03-Credits, L:T:P (3:0:0)</b> |
| <b>Hrs/Week: 03</b>    |                          | <b>CIE Marks:50</b>              |
| <b>Total Hours: 40</b> |                          | <b>SEE Marks:50</b>              |

| <b>UNIT - I</b>   | <b>10 Hrs</b> |
|---|---------------|
| <p><b>Semiconductor Diodes:</b> Introduction, PN junction diode, characteristics and parameters, diode approximations, DC load line analysis</p> <p><b>Diode Applications:</b> Introduction, half wave rectification, full wave rectification, full wave rectifier power supply: Capacitor filter circuit, voltage multiplier, diode logic gates</p> <p><b>Zener Diodes:</b> Junction breakdown, circuit symbol and package, characteristics and parameters, equivalent circuit, Zener diode voltage regulator.</p> <p>Self-study component: ESAKI diode and its working</p>  |               |
| <b>UNIT – II</b>  | <b>10 Hrs</b> |
| <p><b>Bipolar Junction Transistors:</b> Introduction, BJT voltages and currents, common base characteristics, common emitter characteristics, common collector characteristics,</p> <p><b>BJT Biasing:</b> Introduction, DC load line and bias point, BJT amplification, voltage divider bias.</p> <p><b>Amplifier and Oscillator:</b> Single stage CE-amplifier, RC-phase shift oscillator, LC oscillator</p> <p>Self-study component: BJT as a switch</p>   |               |
| <b>UNIT - III</b>   | <b>10 Hrs</b> |
| <p><b>Operational Amplifiers:</b> Introduction, the operational amplifier, block diagram representation of typical op-amp, schematic symbol, op-amp parameters - gain, input resistance, output resistance, CMRR, slew rate, bandwidth, input offset voltage, input bias current and input offset current, the ideal op-amp, equivalent circuit of op-amp, open loop op-amp configurations, differential amplifier, inverting &amp; non inverting amplifier</p> <p><b>Op-Amp Applications:</b> Inverting configuration, non-inverting configuration, differential configuration, voltage follower, integrator, differentiator</p> <p>Self-study component: Op-Amp as zero crossing detector</p> |               |
| <b>UNIT - IV</b>  | <b>10 Hrs</b> |
| <p><b>Boolean Algebra and Logic Circuits:</b> Binary numbers, number base conversion, octal &amp; hexadecimal numbers, complements, basic definitions, axiomatic definition of Boolean algebra, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, other logic operations, digital logic gates</p> <p><b>Combinational logic:</b> Introduction, design procedure, adders- half adder, full adder</p> <p>Communications: Introduction to communication, communication system, modulation</p> <p>Self-study component: Half subtractor and full subtractor</p>  |               |
| <p><b>Reference books:</b></p> <ol style="list-style-type: none"> <li>1) Mike Tooley, ‘Electronic Circuits, Fundamentals &amp; Applications’, 4<sup>th</sup> Edition, Elsevier, 2015.</li> <li>2) Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203- 0417-84.</li> <li>3) D P Kothari, I J Nagrath, ‘Basic Electronics’, 2<sup>nd</sup> edition, McGraw Hill Education (India),Private Limited, 2018</li> </ol>   |               |
| <p><b>Course Outcomes:</b></p> <p>A student who successfully completes this course should be able to</p> <p><b>CO1:</b> Design the basic circuits to get V-I characteristics of semiconductor devices.</p> <p><b>CO2:</b> Design a BJT amplifier to meet the given specifications.</p> <p><b>CO3:</b> Identify and analyze the different configurations of operational amplifier.</p>   |               |



**CO4:** Design simple logic circuits using basic gates.  
**CO5:** Design type of modulation necessary for a given communication applications.

| Course Outcomes | Programme Outcomes |   |   |   |   |   |   |   |   |    |    |          |
|-----------------|--------------------|---|---|---|---|---|---|---|---|----|----|----------|
|                 | 1                  | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12       |
| <b>CO1</b>      | 3                  | 3 | 2 | - | 2 | 2 | - | - | - | -  | -  | -        |
| <b>CO2</b>      | 3                  | 2 | 3 | - | 2 | 1 | - | - | - | -  | -  | -        |
| <b>CO3</b>      | 3                  | 2 | 3 | - | 3 | - | - | - | 1 | -  | -  | -        |
| <b>CO4</b>      | 2                  | 1 | 1 | - | 2 | 1 | - | - | 1 | -  | -  | <b>1</b> |
| <b>CO5</b>      | 2                  | 1 | 1 | - | 2 | 1 | - | - | 1 | -  | -  | <b>1</b> |

**Syllabus for**  
**B.E. III & IV – Semester**  
**(For students admitted to I year in 2021-22)**

|  |   |                    |
|--|---|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UMA301C</b> | <b>Numerical Techniques and Integral<br/>Transforms</b> | <b>Credits: 03</b> |
| <b>L:T:P - 3-0-0</b>                     |   | CIE Marks: 50      |
| Total Hours/Week: 3                      |   | SEE Marks: 50      |

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| <b>UNIT-I</b> | <b>xx Hrs.</b> |
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Numerical Analysis-I: Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).

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| <b>UNIT-II</b> | <b>xx Hrs.</b> |
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Numerical Analysis-II: Numerical differentiation using Newton's forward and backward formulae-problems. Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems. Euler's and Modified Euler's method, Runge-Kutta 4<sup>th</sup> order method.

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| <b>UNIT-III</b> | <b>xx Hrs.</b> |
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Fourier series: Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

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| <b>UNIT-IV</b> | <b>xx Hrs.</b> |
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Fourier transforms and z-transforms: Infinite Fourier transforms and inverse Fourier transforms-simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems

|                          |
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| <b>Reference Books *</b> |
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| <b>Textbooks:</b> |
|-------------------|

1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.

|                        |
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| <b>Reference Book:</b> |
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1. Advanced Engineering Mathematics by E Kreyszig ( John Wiley & Sons)

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| <b>Course Outcomes**</b> |
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**After completion of the course student will be able to**

1. Solve engineering problems using non-linear equations and interpolation techniques.
2. Solve problems using numerical differentiation and numerical integration.
3. Perform numerical solutions of ordinary differential equations.
4. Understand Fourier analysis that provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.
5. Understand the basic concepts of Fourier transforms and z –transforms, to solve ode, pde and difference equations.



|                      |   |                   |
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| <b>21UEC302C</b>     | <b>Electronic devices and Circuits Design</b> | <b>Credits:03</b> |
| L:T:P - 3 : 0: 0     |   | CIE Marks: 50     |
| Total Hours/Week: 03 |   | SEE Marks: 50     |

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| <b>UNIT-I</b> | <b>10Hrs.</b> |
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**Field Effect Transistors:** Introduction, construction, operation and characteristics of JFETs, transfer characteristics, depletion type MOSFET, enhancement type MOSFET, practical applications.  
**Thyristors:** Introduction, construction, operation and characteristics of SCR, TRIAC, UJT.  
**Diode applications:** clippers and clampers.  
**Self-study component:** Comparison between Si and Ge diode, study of Data sheets of different types of Si and Ge diodes, Zener diodes.

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| <b>UNIT-II</b> | <b>10 Hrs.</b> |
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**Optoelectronic Devices:** Light units, Light emitting diode (LED), liquid crystal displays (LCD), photo conductive cell, photo diode and solar cells, photo transistors, opto-couplers.  
**Miscellaneous Devices:** Schottky diode, varactor diode, power diode, tunnel diode.  
**Self-study components:** Voltage Variable Capacitors (VVC) , Thermistors: operation ,characteristics and applications.

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| <b>UNIT-III</b> | <b>10 Hrs.</b> |
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**FET Biasing:** Introduction, Fixed bias configuration, Self bias configuration, Voltage divider biasing, Common gate configuration, Design, Trouble shooting, p-channel FETs, Universal JFET bias curve.  
**Self-study components:** Study of multistage amplifier: classification, distortions in amplifier, two stage RC coupled amplifier and its frequency response.

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| <b>UNIT-IV</b> | <b>10 Hrs.</b> |
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**FET amplifiers:** Introduction, JFET small signal model, voltage divider bias configuration.  
**Power Supplies (Voltage Regulators) :** Introduction, general filter considerations, capacitor filter, RC filter, discrete transistor voltage regulation, IC voltage regulators.

**Reference Books \***

- Nashelesky & Boylestead, 2009, "Electronic Devices & Circuit Theory" 10<sup>th</sup> Edition, Pearson
- D.A.Bell, 2007, "Electronic Devices & Circuit" , 4<sup>th</sup> Edition, PHI
- M. D. Singh, K. B. Khanchandani, 2007, "Power Electronics", 2<sup>nd</sup> Edition, McGraw Hill Publication

**Course Outcomes\*\***

**After completion of the course student will be able to**

- Analyze different types of electronic devices and design clipper and clamper circuits.
- Differentiate the characteristics and importance of different optoelectronic devices.
- Choose a specific FET and other components to design an amplifier.
- Design a regulated power supply to meet the given specifications.

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |          |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|----------|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2        | 3 |
| <b>CO1</b>      | 3                        | 2 | 3 | - | - | - | - | - | - | -  | -  | -  | <b>3</b>                         | <b>2</b> |   |
| <b>CO2</b>      | 3                        | 3 | 3 | - | - | - | - | - | - | -  | -  | -  | <b>3</b>                         | -        | - |
| <b>CO3</b>      | 3                        | 3 | 3 | - | - | - | - | - | - | -  | -  | -  | <b>3</b>                         | -        | - |
| <b>CO4</b>      | 3                        | 3 | 3 | - | - | - | - | - | - | -  | -  | -  | <b>3</b>                         | <b>1</b> | - |

|                             |   |                      |
|-----------------------------|---|----------------------|
| <b>21UEC303C</b>            | <b>Digital Electronics and Logic Design</b> | <b>Credits: 03</b>   |
| <b>L:T:P - 3 : 0: 0</b>     |   | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 40</b> |   | <b>SEE Marks: 50</b> |

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| <b>UNIT-I</b> | <b>10 Hrs.</b> |
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**Principles of Combinational Logic and Design:** Review of Boolean algebra, simplification and implementation of Boolean expression using basic gates and universal gates. Definition of combinational logic, canonical forms, generation of switching equations from truth tables, K-maps (up to 5 variables), Quine-McCluskey minimization technique, map entered variables.

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| <b>UNIT-II</b> | <b>10Hrs.</b> |
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**Analysis and Design of Combinational Circuit using MSI Components:** General approach, binary adder and subtractors, cascading full adders, look ahead carry, decimal adders, comparators, decoders, encoders, multiplexers.

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| <b>UNIT-III</b> | <b>10Hrs.</b> |
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**Flip-Flops:** The basic bistable element, latches, timing considerations, master-slave SR flip-flops, master slave JK flip-flop, edge triggered flip-flop, positive edge triggered D flip-flop, negative edge triggered D flip-flop, characteristic equations.

**Applications of Flip-Flops:** Registers (SISO, SIPO, PISO and PIPO) and bidirectional shift register.

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| <b>UNIT-IV</b> | <b>10Hrs.</b> |
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**Applications of Flip-Flops:** Counters, binary ripple counters, synchronous binary counters, counters based on shift registers, design of synchronous counters, design of asynchronous counter using clocked JK, D, T and SR flip-flops.

**Sequential Circuit Design and Analysis:** Introduction to Mealy and Moore models, state machine notation, synchronous sequential circuit analysis, construction of state diagrams.

|                          |
|--------------------------|
| <b>Reference Books *</b> |
|--------------------------|

1. Donald D Givone, 2002, “ Digital Principle and Design ”. Tata McGraw Hill
2. John M Yarbrough, 2001,“Digital Logic Applications and Design”, Thomson Learning
3. Thomas L. Floyd, “Digital Fundamentals”, 9<sup>th</sup> edition, PHI
4. Charles H Koth, 2004,“Fundamentals of Logic Design”, Thomson learning
5. Meno and Kim, 2001,“Logic and Computer Design Fundamentals”,2<sup>nd</sup> edition ,Pearson
6. Malvino and Leech, “Digital Principles & Applications”, 2<sup>nd</sup> edition, PHI

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| <b>Course Outcomes**</b> |
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- After completion of the course student will be able to**
1. Simplify the given Boolean expressions using Boolean algebra, K-map, Quine McCluskey and map entered variables methods.
  2. Design and analyse combinational circuits using i) basic gates ii) universal gates iii) MUXs and iv) decoder and gates.
  3. Analyse different types of latches, flip flops and shift registers.
  4. Design, model and analyse synchronous and asynchronous sequential circuits.

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 1 | 1 | 1 | 1 | - | 1 | - | - | -  | -  | -  | 3                                | 1 |   |
| CO2             | 3                        | 3 | 3 | 2 | 1 | - | 1 | - | - | -  | -  | -  | 3                                | 1 |   |
| CO3             | 3                        | 3 | 3 | 2 | 1 | - | 1 | - | - | -  | -  | -  | 3                                | 1 |   |
| CO4             | 3                        | 2 | 3 | 2 | 2 | - | 1 | - | - | -  | -  | -  | 3                                | 1 |   |

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|-----------------------------------|-------------------------|----------------------|
| <b>SUBJECT CODE:</b><br>21UEC304C | <b>Network Analysis</b> | <b>Credits: 03</b>   |
| <b>L:T:P – 3-0-0</b>              |                         | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 03</b>       |                         | <b>SEE Marks: 50</b> |

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| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <b>Basic concepts:</b> Concept of voltage, current and power, ideal and practical representation of energy sources, source transformation, network reduction using star-delta transformation, mesh current and node voltage analysis with dependent and independent sources for AC and DC networks, concept of super mesh and super node.  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <b>Network theorems:</b> Superposition, Millman's, Thevenin's, and Maximum power transfer theorems.<br><b>Network topology:</b> Graph of a network, concept of tree and co-tree, incidence matrix, tie-set matrix, cut-set matrix, analysis of networks, network equilibrium equations.  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <b>Resonance circuits:</b> Series and parallel resonance circuits, frequency of resonance, frequency responses, Q-factor, bandwidth. <b>Two port network parameters:</b> Z, Y, h, transmission parameters and relationship between parameters.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <b>Laplace transformation:</b> Basic theorems, Laplace transform of periodic functions, application of Laplace transform to RL and RC circuits. <b>Attenuators:</b> Symmetrical T, PI, bridge T, Lattice attenuators, Asymmetrical T, L, and PI attenuators. <b>Equalizers:</b> Two terminal series and shunt equalizers.  |                |
| <b>Reference Books *</b>   |                |
| <b>Textbooks:</b>  |                |
| 1. Roy Choudhary, "Networks and systems", 2 <sup>nd</sup> Edition, New Age International Publications, 2006.<br>G. K. Mithal, "Network Analysis", Khanna Publishers, 1997.   |                |
| <b>Reference Books:</b>  |                |
| 1. Hayt, Kemmerly and Durbin, "Engineering Circuit Analysis", 6 <sup>th</sup> Edition, TMH, 2006.<br>2. M.E. Van Valkenberg "Network analysis", Prentice Hall of India, 3 <sup>rd</sup> Edition, 2000.   |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b>  |                |
| <ol style="list-style-type: none"> <li><b>Simplify networks using source transformation, star-delta conversion and determine current, voltage, power using nodal and mesh analysis to AC and DC networks.</b></li> <li><b>Apply network theorems and topology for complex networks to find responses.</b></li> <li><b>Analyze series and parallel resonant circuits and find different network parameters.</b></li> <li><b>Apply concept of Laplace transformation to networks and waveforms, design attenuators and simple equalizers.</b></li> </ol> |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus  
 \*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 2 | 1 | 2 | 1 | 1 | - | - | 1 | -  | -  | 1  | 3                                | - | - |
| CO2             | 3                        | 3 | 1 | 2 | 1 | 1 | - | - | 1 | -  | -  | 1  | 3                                | - | - |
| CO3             | 3                        | 3 | 1 | 2 | 1 | 1 | - | - | 1 | -  | -  | 1  | 3                                | - | - |
| CO4             | 3                        | 2 | 1 | 2 | 1 | 1 | - | - | 1 | -  | -  | 1  | 3                                | - | - |



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|--|----------------------------------|----------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC305C</b> | <b>Data Structures using “C”</b> | <b>Credits: 03</b>   |
| <b>L:T:P – 3-0-0</b>                     |                                  | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 03</b>              |                                  | <b>SEE Marks: 50</b> |

| <b>UNIT-I</b>   | <b>xx Hrs.</b> |
|---|----------------|
| <p>Introduction: Data structures, classifications (primitive &amp; non primitive), data structure operations, pointers and dynamic memory allocation, pointers to arrays , structures, self-referential structures, pointers to structures.</p> <p>Functions: Functions (Passing structure variable as an argument, passing whole structure as argument, passing structure variable as a pointer argument, etc).</p>  |                |
| <b>UNIT-II</b>  | <b>xx Hrs.</b> |
| <p>Dynamically allocated arrays (Using calloc() or malloc()), array Operations: traversing, inserting, deleting, searching, and sorting. Stacks: definition, stack operations (push, pop and display. Test: underflow and overflow conditions), array representation of stacks, stacks using dynamic arrays, Stack Applications: infix to postfix conversion, evaluation of postfix expression, program to evaluate postfix expression, program to convert Infix to Postfix expression.</p>   |                |
| <b>UNIT-III</b>   | <b>xx Hrs.</b> |
| <p>Recursion - Factorial, GCD, Fibonacci sequence, tower of Hanoi. Queues: Definition, array representation, queue operations (Insert, delete and display), circular queues operations (Insert, delete and display), De-queues(Insert, delete and display), Priority Queues(Insert, delete and display). programming examples.</p>  |                |
| <b>UNIT-IV</b>  | <b>xx Hrs.</b> |
| <p>Linked Lists: Definition, representation of linked lists in memory, Linked list operations: Traversing, searching, insertion, and deletion. Doubly linked lists(Traversing, searching, insertion, and deletion), Circular linked lists(Traversing, searching, insertion, and deletion). Implementation of stack and queue using singly linked list. Programming Examples.</p>  |                |
| <b>Reference Books *</b>  |                |
| <b>Text Books</b>   |                |
| <ol style="list-style-type: none"> <li>1. Ellis Horowitz and Sartaj Sahni, ” Fundamentals of Data Structures in C”, Universities Press, 2<sup>nd</sup> Edition, 2014</li> <li>2. Gilberg &amp; Forouzan, ” A Pseudo-code approach with C”, Cengage Learning, 2<sup>nd</sup> Edition, 2014</li> <li>3. Seymour Lipschutz, Schaum's Outlines, “ Data Structures”, McGraw Hill, Revised 1<sup>st</sup> Edition, 2014</li> <li>4. Behrouz A. Forouzan and Richard F. Gilberg, “ Computer Science A Structured Programming Approach Using C”, Thomson, 2<sup>nd</sup> Edition</li> </ol> |                |
| <b>Reference Books</b>  |                |
| <ol style="list-style-type: none"> <li>1. A M Tenenbaum, “ Data Structures using C”, PHI, 1989 Robert Kruse, “ Data Structures and Program Design in C”, PHI, 2nd edition, 1996</li> </ol>  |                |
| <b>Course Outcomes**</b>  |                |

After completion of the course student will be able to

1. Demonstrate the concepts of a) various types of data structures, operations and algorithms, b) Sorting and searching operations.
2. Analyze the performance of stack, queue, lists, trees, and searching and sorting techniques.
3. Write the C programs for all the applications of data structures.
4. To solve real world problems by applying data structure concepts.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | - | - | - | 2 | 1 | - | - | -  | -  | 1  | 2                                | - | 2 |
| CO2             | 3                        | 2 | - | - | - | 1 | 1 | - | - | -  | -  | 2  | 2                                | - | 2 |
| CO3             | 3                        | 3 | - | - | - | 1 | 1 | - | - | -  | -  | 3  | 2                                | - | 2 |
| CO4             | 3                        | 2 | - | - | - | 1 | 2 | - | - | -  | -  | 3  | 2                                | - | 2 |

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|--|---|----------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC306L</b> | <b>Electronic Devices and Circuits Laboratory</b> | <b>Credits: 01</b>   |
| <b>L:T:P – 0-0-3</b>                     |   | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 03</b>              |   | <b>SEE Marks: 50</b> |

| <b>Sl. No</b> | <b>LIST OF THE EXPERIMENTS</b>  |
|---------------|---|
| 1.            | V-I characteristics and analysis of diode.  |
| 2.            | Analysis of diode as a half-wave and full-wave rectifier.   |
| 3.            | V-I characteristics and their analysis of Zener diode.  |
| 4.            | Zener diode as a voltage regulator and its regulation analysis.   |
| 5.            | Input and output characteristics and their analysis of Bipolar Junction Transistor (BJT) in common base, common collector and common emitter configuration. |
| 6.            | Design, implementation and frequency response of transistor (BJT) as an amplifier   |
| 7.            | Design and implementation of transistor (BJT) as an oscillator.   |
| 8.            | Input and output characteristics and their analysis of field effect transistor (FET).   |
| 9.            | Design, implementation and frequency response of FET as an amplifier.   |
| 10.           | V-I characteristics and analysis of unijunction transistor (UJT).   |
| 11.           | Implementation of UJT as a relaxation oscillator.   |
| 12.           | V-I characteristics and analysis of silicon controlled rectifier (SCR).   |
| 13.           | Study of SCR as half-wave and full-wave controlled rectifier.   |
| 14.           | Simulation and analysis of Amplifiers and Oscillators.  |
| 15.           | Simulation and analysis of DC and AC excited RL and RC circuits.  |

#### **Course Outcomes\*\***

After completion of the course student will be able to

- 1. Characterize semiconductor devices based on their characteristics.**
- 2. Realize rectifiers, controlled rectifiers and regulators.**
- 3. Design amplifiers and oscillators for given specifications.**
- 4. Simulate and analyze basic electronic circuits.**

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| <b>Course Outcomes</b> | <b>Programme Outcomes (POs)</b> |          |          |          |          |          |          |          |          |           |           |           | <b>Program Specific Outcomes (PSOs)</b> |          |          |
|------------------------|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|---|----------|----------|
|                        | <b>1</b>                        | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>1</b>                                | <b>2</b> | <b>3</b> |
| <b>CO1</b>             | 3                               | 2        | 1        | 1        | 2        | 2        | 1        | 2        | 2        | 2         | 2         | 2         | 3                                       | 0        | 0        |
| <b>CO2</b>             | 3                               | 2        | 2        | 2        | 3        | 2        | 2        | 3        | 2        | 2         | 2         | 1         | 3                                       | 0        | 0        |
| <b>CO3</b>             | 3                               | 2        | 2        | 2        | 2        | 3        | 2        | 3        | 2        | 3         | 2         | 3         | 3                                       | 0        | 0        |
| <b>CO4</b>             | 3                               | 2        | 2        | 1        | 3        | 1        | 2        | 3        | 1        | 2         | 1         | 3         | 3                                       | 0        | 0        |

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| <b>SUBJECT CODE:</b><br><b>21UEC307L</b> | <b>Digital Electronics Laboratory</b> | <b>Credits: 1</b> |
|--|---------------------------------------|-------------------|

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| <b>L:T:P – 0-0-3</b>        |
| <b>Total Hours/Week: 03</b> |

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|----------------------|
| <b>CIE Marks: 50</b> |
| <b>SEE Marks: 50</b> |

### LIST OF THE EXPERIMENTS

| Sl. No. |  |  |
|---------|--|--|
| 1       | Simplification, realization of Boolean expression(s) using basic logic gates.  |  |
| 2       | Implementation of Boolean expression(s) using universal gates.   |  |
| 3       | Design of full adder and full subtractor implementation using basic logic gates.   |  |
| 4       | Realization of<br>a. Parallel adder / subtractor using 7483chip<br>b. Decoder chip to drive LED display  |  |
| 5       | Design and implementation of code converters (any two).  |  |
| 6       | Implementation of three variable Boolean expression(s) using<br>a. 8:1MUX<br>b. 4:1MUX   |  |
| 7       | Implementation of three variable Boolean expression(s) using 3:8 decoder and gates.  |  |
| 8       | Design of two-bit comparator using basic logic gates and study of 7485 magnitude comparator.   |  |
| 9       | Truth table verification of flip-flops:<br>a. Master Slave JK flip-flop implementation using only NANDgates<br>b. JK flip flop using 7476.   |  |
| 10      | Design of<br>a. 4-bit asynchronous up counter using JK flip-flop(7476)<br>b. 4-bit asynchronous down counter using JK flip-flop(7476)<br>c. Mod-n asynchronous counter (7476) ( $n \leq 4$ ) |  |
| 11      | Design of<br>a. UP counter using 74193<br>b. DOWN counter using 74193  |  |
| 12      | Design of shift registers using 7495 viz. SIPO, SISO, PISO, PIPO shift right, shift left.  |  |
| 13      | Simulate any 6 experiments covering both combinational and sequential circuits using circuit simulator- PROTEUS VSM.   |  |

### Course Outcomes\*\*

After completion of the course student will be able to

1. Should be able to design combinational circuits and implement it using a) basic logic Gates b) universal gates, c) multiplexers and d) decoder and gates
2. Should be able to design and realize latches and flip flops
3. Should be able to design and implement asynchronous counters
4. Should be able to design and implement synchronous counters and shift registers
5. Should be able to simulate combinational and sequential circuit using PROTEUS software

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable



|  |                                    |                      |
|--|------------------------------------|----------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC308C</b> | <b>Higher Programming Paradigm</b> | <b>Credits: 01</b>   |
| <b>L:T:P – 2-0-0</b>                     |                                    | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 02</b>              |                                    | <b>SEE Marks: 50</b> |

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|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <p><b>Datatypes in python:</b> comments in python, Docstrings, How python sees variables, Datatypes in python, Sequences in python, Literals in python, Determining the data type of a variable, Identifiers and reserved words, Naming conventions in python</p> <p><b>Operators in Python:</b> Operator, operator precedence and associativity, Mathematical functions</p> <p><b>Input and Output:</b> Output statements, Input statements, Command Line arguments</p> <p><b>Control Statements Strings and Characters</b></p> |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p><b>Functions:</b> Defining a function, calling a function, Returning Results from a function, Returning multiple values from a function, Formal and actual arguments, local and global variables, passing a group of elements to a function, recursive functions, the special variable __nam. <b>Lists and tuples: lists, tuple , Dictionaries.</b></p>   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p>Exceptions: exceptions, exception handling, types of exceptions, user defined exceptions</p> <p><b>Files in python:</b> files, types of files in python, opening a file, closing a file, working with text files containing strings, working with binary files, pickle in python.</p>   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p><b>Object Oriented Programming:</b> Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism.</p>  |                |
| <b>Reference Books *</b>   |                |
| <p><b>Text Books</b></p> <p>1. Core Python Programming by Dr. R.NageswawaRao, Dreamtech press, 2<sup>nd</sup> Edition 2018.</p> <p><b>Reference Books</b></p> <p>1. Introduction to Python Programming by Gowrishankar S. Veena A. , CRC Press Taylor &amp; Francis Group, 1<sup>st</sup> Edition 2019.</p> <p>2. Python Programming by Michael Urban and Joel Murach , Mike Murach Elizabeth Drake, 1<sup>st</sup> Edition,2016</p>   |                |
| <b>Course Outcomes**</b>   |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li><b>1. Explain syntax and semantics of different statements and functions in Python.</b></li> <li><b>2. Demonstrate the use of strings, files, lists, dictionaries and tuples in simple applications.</b></li> <li><b>3. Demonstrate Exception Handling and file operations.</b></li> <li><b>4. Explain class, objects, polymorphism, inheritance.</b></li> </ol>   |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |          | Program Specific Outcomes (PSOs) |          |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----------|----------------------------------|----------|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12       | 1                                | 2        | 3 |
| <b>CO1</b>      | 3                        | 3 | 2 | - | 2 | 2 | - | - | - | -  | -  | -        |                                  | <b>3</b> |   |
| <b>CO2</b>      | 3                        | 2 | 3 | - | 2 | 1 | - | - | - | -  | -  | -        |                                  | <b>3</b> |   |
| <b>CO3</b>      | 3                        | 2 | 3 | - | 3 | - | - | - | 1 | -  | -  | -        |                                  | <b>3</b> |   |
| <b>CO4</b>      | 2                        | 1 | 1 | - | 2 | 1 | - | - | 1 | -  | -  | <b>1</b> |                                  | <b>3</b> |   |

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|--|-------------------------------------|---------------------------|
| <b>SUBJECT CODE:</b><br><b>21UMA300M</b> | <b>Bridge Course Mathematics -I</b> | <b>Credits: Mandatory</b> |
| L:T:P -                                  |                                     | CIE Marks: 50             |
| Total Hours/Week:03                      |                                     | SEE Marks: 50             |

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| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <b>Differential Calculus:</b> Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only) without proof. Problems   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <b>Partial differentiation:</b> Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <b>Integral Calculus:</b> Evaluation of double and triple integrals. Area bounded by the curve. Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <b>Vector Calculus:</b> Vector Differentiation: Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems   |                |
| <b>Reference Books *</b>   |                |
| <b>Textbooks:</b>  |                |
| <ol style="list-style-type: none"> <li>1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43<sup>rd</sup> Ed., 2015.</li> <li>2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley &amp; Sons, 10<sup>th</sup> Ed.(Reprint), 2016.</li> </ol>  |                |
| <b>Reference Books:</b>  |                |
| <ol style="list-style-type: none"> <li>1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)</li> <li>2. <b>Calculus:</b>Early Transcendentals James Stewart</li> <li>3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6<sup>th</sup> Edition, McGraw-Hill Book Co., New York, 1995.</li> <li>4. B.V. Ramana: "Higher Engineering Mathematics" 11<sup>th</sup> Edition, Tata McGraw-Hill, 2010.</li> <li>5. Veerarajan T., "Engineering Mathematics for First year", Tata McGraw-Hill, 2008.</li> <li>6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7<sup>th</sup> Ed., 2010.</li> </ol> |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b>  |                |
| <ol style="list-style-type: none"> <li>1. Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.</li> <li>2. Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.</li> <li>3. Apply the concept of multiple integrals and their usage in computing the area and volumes.</li> <li>4. Apply the knowledge of vector calculus to solve the engineering problems</li> </ol>  |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus



**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO2</b>      | 3                        | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO3</b>      | 3                        | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO4</b>      | 3                        | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

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|--|---|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UMA401C</b> | <b>Statistics and Probability Distributions</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |   | CIE Marks: 50      |
| Total Hours/Week: 03                     |   | SEE Marks: 50      |

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|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <p>Statistics: Curve fitting by the method of least squares <math>y = a + bx</math>, <math>y = ab^x</math>, <math>y = a + bx + cx^2</math><br/> Correlation, expression for the rank correlation coefficient and regression.</p>   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p>Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Discrete and continuous random variables-Probability density function, Cumulative distribution function, Problems on expectation and variance</p>  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p>Probability distributions: Binomial distributions Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.</p>  |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p>Markov chains: Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.</p>  |                |
| <b>Reference Books *</b>   |                |
| <ol style="list-style-type: none"> <li>Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.</li> <li>Theory and problems of probability by Seymour Lipschutz (Schaum's Series).</li> <li>Advanced Engineering Mathematics by H. K. Dass</li> <li>Advanced Engineering Mathematics by E Kreyszig ( John Wiley &amp; Sons)</li> <li>Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2<sup>nd</sup> edition 2012.</li> <li>Advanced Engineering Mathematics by Peter V. O'Neil. Author/s last Name, initial (Year), Book Title (edition), Publisher</li> </ol> |                |
| <b>Course Outcomes**</b>   |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li><b>To apply the least square sense method to construct the specific relation for the given group of data.</b></li> <li><b>To understand the concept of probability.</b></li> <li><b>To apply the concept of probability to find the physical significance of various distribution phenomena.</b></li> <li><b>To understand the concepts of probability distributions.</b></li> <li><b>To apply the concept of Markov Chain for commercial and industry purpose.</b></li> </ol>   |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |    |    |    |    |    |    |    |    |    |    |    | Program Specific Outcomes (PSOs) |    |     |
|-----------------|--------------------------|----|----|----|----|----|----|----|----|----|----|----|----------------------------------|----|-----|
|                 | 1                        | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 1                                | 2  | 3   |
| CO1             | 1                        | 2  | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1                                | 2  | --  |
| CO2             | 1                        | 2  | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1                                | 2  | --  |
| CO3             | 1                        | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1                                | -- | --  |
| CO4             | 1                        | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1                                | -- | --- |
| CO5             | 1                        | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1                                | -- | --  |

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|----------------------|----------------------------|--------------------|
| <b>21UEC402C</b>     | <b>Signals and Systems</b> | <b>Credits: 03</b> |
| L:T:P - 2 : 2: 0     |                            | CIE Marks: 50      |
| Total Hours/Week: 04 |                            | SEE Marks: 50      |

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|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Introduction: Definition of signals and systems, classification of signals, elementary signals, basic operations on signals, interconnection of systems and operations, properties of systems.   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| Time domain representation of LTI systems: Convolution sum, convolution integral, impulse response representation. Properties of impulse response.   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| Fourier and inverse Fourier representation of signals: Introduction to complex sinusoidal signals and their use in Fourier representation of periodic signals (brief review of CTFS and DTFS). Continuous time Fourier transform, Discrete time Fourier Transform (DTFT), properties of DTFT and applications.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| Z -Transforms: Introduction, properties of ROC, properties of Z-transform and relation of Z -transform with Fourier transforms. Inverse Z-transform, transform analysis of LTI systems, transfer function, stability and causality, and solution of difference equations using Z-transform.  |                |
| <b>Reference Books *</b>   |                |
| 1. Simon Haykin and Barry Van Veen, Signals and Systems (2 <sup>nd</sup> Edition), John Wiley & Sons<br>2. Michel J. Roberts, 2003 , Signals and Systems (2 <sup>nd</sup> Edition), Tata McGraw Hill<br>3. Allan V. Oppenheim, Alan S. Willsky, and Hamid Nawab, 1997, Signals and Systems (2 <sup>nd</sup> Edition), Pearson Education Asia.  |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able</b>   |                |
| <ol style="list-style-type: none"> <li>1. Represent, characterize, and analyze CT and DT signals and systems.</li> <li>2. Analyze CT and DT systems in time domain using convolution.</li> <li>3. Analyze CT and DT systems in frequency domain, using Fourier tools like CTFT and DTFT.</li> <li>4. Apply z-transform and its properties in the analysis of discrete-time signals and systems.</li> </ol> |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO2             | 3                        | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO3             | 3                        | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO4             | 3                        | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

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|----------------------|--|--------------------|
| <b>21UEC403C</b>     | <b>Linear Integrated Circuits and Its Applications</b> | <b>Credits: 03</b> |
| L:T:P - 3 : 0 : 0    |  | CIE Marks: 50      |
| Total Hours/Week: 03 |  | SEE Marks: 50      |

| UNIT-I   | 10 Hrs. |
|--|---------|
| <p><b>Differential Amplifiers:</b> Introduction, differential amplifier, differential amplifier circuit configurations, dual- input balanced output differential amplifier, dual- input unbalanced output differential amplifier, single input balanced output differential amplifier, single input unbalanced output differential amplifier, constant current bias, current mirror, cascaded differential amplifier stages, level translator.</p> <p><b>Introduction to operational amplifiers:</b> Introduction, block diagram representation of a typical op-amp, the ideal op-amp, equivalent circuit of an op-amp, ideal voltage transfer curve, open loop op-amp configurations.</p> <p><b>Self study component:</b> Numericals on differential amplifiers</p> |         |
| UNIT-II  | 10 Hrs. |
| <p><b>An op-amp with negative feedback:</b> Block diagram representation of feedback configuration, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier.</p> <p><b>The practical op-amp:</b> Input offset voltage, input bias current, input offset current, total output offset voltage, common mode configuration, common mode rejection ratio, power supply rejection ratio, slew rate</p> <p><b>Self study component:</b> To derive gain, input resistance of differential amplifier with three op-amps</p>  |         |
| UNIT-III   | 10 Hrs. |
| <p><b>General applications:</b> The peaking amplifier, summing, scaling and averaging amplifiers, integrator, differentiator.</p> <p><b>Active filters:</b> First order and second order low pass butter worth filter, first order and second order high pass butter worth filter, higher order filters, band pass filter, band reject filters.</p> <p><b>Self study component:</b> To study All pass filter</p>   |         |
| UNIT-IV  | 10 Hrs. |
| <p><b>Oscillators and waveform generator:</b> Introduction, phase shift oscillator, wien bridge oscillator, square wave generator, triangular wave generator.</p> <p><b>Comparators and converters:</b> Basic comparator, zero crossing detector, sample and hold circuit.</p> <p><b>The 555 Timer:</b> Block diagram, connection diagram, 555 timer as Astable and Monostable multivibrators</p> <p><b>Self study component:</b> To study voltage-controlled oscillator and Schmitt trigger</p>   |         |
| <b>Reference Books *</b>   |         |
| <ol style="list-style-type: none"> <li>Gayakwad Ramakanth A. "Operational Amplifiers and Linear Integrated Circuits", 3<sup>rd</sup> &amp; 4<sup>th</sup> Edition, PHI.</li> <li>D. Roy Choudary, "Linear Integrated Circuits", 2<sup>nd</sup> Edition.</li> </ol>   |         |
| <b>Course Outcomes**</b>   |         |

**After completion of the course student will be able to**

1. Identify and analyze the different configurations of differential amplifier.
2. Analyze the different feedback amplifiers and various parameters of practical op-amp.
3. Design the active filters and amplifiers using op-amp.
4. Design waveform generators, data comparators and converters.

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 1 | 1 | 1 | - | - | - | 1 | -  | -  | -  | 3                                | 1 | - |
| <b>CO2</b>      | 3                        | 3 | 1 | 1 | 1 | - | - | - | 1 | -  | -  | -  | 3                                | 1 | - |
| <b>CO3</b>      | 3                        | 3 | 2 | 2 | 1 | 1 | 1 | - | 1 | -  | 1  | 1  | 3                                | 1 | - |
| <b>CO4</b>      | 3                        | 2 | 2 | 1 | 1 | 1 | 1 | - | 1 | -  | 1  | 1  | 3                                | 1 | - |

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|------------------------------|---|----------------------|
| <b>21UEC404C</b>             | <b>Analog and Digital Communication</b> | <b>Credits: 03</b>   |
| <b>L : T : P - 3 : 0 : 0</b> |   | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 03</b>  |   | <b>SEE Marks: 50</b> |

| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
|--|----------------|
| <p><b>Linear modulation:</b> Baseband and carrier communication, time domain and frequency domain description, generation and detection of Amplitude Modulation (AM) waves.</p> <p><b>DSB-SC modulation:</b> Time and frequency domain representation, generation and detection of DSB-SC modulated waves.</p> <p><b>SSB modulation:</b> Time domain representation of SSB signal, generation and detection of SSB modulated waves, Quadrature Amplitude Modulation (QAM).</p> <p><b>Vestigial sideband modulation:</b> Frequency domain representation, generation and detection of VSB, comparison of amplitude modulation techniques, super heterodyne receiver.</p>  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p><b>Angle modulation:</b> Concept of angle modulation, relation between frequency and phase modulation, bandwidth of angle modulated wave.</p> <p><b>Generation of FM:</b> direct and indirect methods, PLL, demodulation of FM, pre-emphasis and de-emphasis, FM radio.</p>   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p><b>Digital Communication:</b> Model of digital communication systems Sampling process: Sampling Theorem, quadrature sampling of Band pass signal, reconstruction of a message from its samples, signal distortion in sampling. Line codes, unipolar, polar and Manchester codes and their power spectral densities.</p>   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p><b>Digital Modulation Techniques:</b> Digital Modulation formats, Coherent binary modulation techniques (ASK, PSK, FSK), Probability of error for each ASK, PSK, FSK. Coherent quadrature modulation techniques, MSK, (without derivation of probability of error equation). Non-coherent binary modulation techniques (FSK and DPSK).</p>  |                |
| <b>Reference Books</b>   |                |
| <ol style="list-style-type: none"> <li>1. B. P. Lathi “Modern Digital and Analog Communication Systems”, 3<sup>rd</sup>Edition, Oxford University, 2006</li> <li>2. Simon Haykin, “Digital communications”, John Wiley, Edition 2014</li> <li>3. George Kennedy “Electronic Communication Systems”, 3<sup>rd</sup>Edition, Tata McGraw Hill Publication, 1984</li> <li>4. B. P. Lathi “Communication Systems”, 3<sup>rd</sup> Edition, B. S. Publications, 2009 Simon Haykin “Communication Systems”, 3<sup>rd</sup> Edition, John Wiley and Sons, 2005</li> <li>5. John. G. Proakis, &amp; Masoul salehi” Fundamental of Communication System” Pearson Education, Edition 2014</li> <li>6. Bernard Sklar and Prabitrakumary Ray, “Digital Communication Fundamentals and Applications”, Pearson Publications, 2010</li> <li>7. K. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley &amp; Sons, 2006</li> </ol> |                |
| <b>Course Outcomes</b>   |                |



After completion of the course student will be able to

1. Compute spectrum of modulated and demodulated signals.
2. Analyze amplitude modulation and demodulation circuits.
3. Do analysis of angle modulation and demodulation techniques.
4. Design sampling and reconstruction circuit for given different sampling frequencies.
5. Design different digital modulation /demodulation techniques.

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO2</b>      | 3                        | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO3</b>      | 3                        | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO4</b>      | 3                        | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO5</b>      | 3                        | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

|  |                             |                    |
|--|-----------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC405C</b> | <b>8051 Microcontroller</b> | <b>Credits: 03</b> |
| L:T:P - 3 : 0: 0                         |                             | CIE Marks: 50      |
| Total Hours/Week: 03                     |                             | SEE Marks: 50      |

|   |                |
|---|----------------|
| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| Microprocessors and Microcontrollers: Introduction, Harvard Vs Von Neumann architecture, comparison between microprocessors and microcontrollers, 8051 Architecture: General features of 8051 Microcontroller, 8051 block diagram, programming model, pin description, 8051 oscillator and clock, general purpose and special function registers, internal RAM and ROM, stack, input/output pins, ports and circuits, external memory.  |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| 8051 Instructions and Programming: addressing modes, types of instructions, instruction set, data move instructions, external data move instructions, arithmetic instructions, logical instructions, jump and call instructions, bit-addressable instructions, programs using all the above instructions and concepts.  |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| Programming peripherals in assembly: Timer and counter programming. Serial Port Programming: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming. Interrupts: 8051 interrupts, Programming timer interrupts.   |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| Programming external hardware interrupts and serial communication interrupts. Interfacing: Introduction, need for interfacing, interfacing the following devices using assembly-LCD module, ADC808/DAC808, key-pad, stepper motor. Interfacing with the 8255: Programming the 8255, Interfacing the 8255.   |                |
| <b>Reference Books *</b>  |                |
| <ol style="list-style-type: none"> <li>1. Kenneth J. Ayala, "The 8051 Micro controller Architecture, Programming &amp; Applications", Penram International, 2nd Edition, 1996</li> <li>2. Muhammad Ali Mazidi, and Janice GillispieMazidi, "The 8051 Micro controller and Embedded Systems", Pearsons Education, 2<sup>nd</sup> edition, 2007.</li> <li>3. Craig Steiner, "The 8051/8052 Microcontroller: architecture, assembly language, and Hardware interfacing", WP Publishers and Distributors, 2006.</li> <li>4. David Calcutt, Fred cwon, "8051 microcontroller", Elsevier, 1<sup>st</sup> Edition, 2004.</li> <li>5. Dr.UmaRao and Dr.AndhePallavi, "The 8051 microcontroller architecture, programming and applications", Pearson Education, 2010.</li> </ol> |                |
| <b>Course Outcomes**</b>  |                |
| <b>After completion of the course student will be able to</b> <ol style="list-style-type: none"> <li>1. Comprehend the architecture of 8051 microcontroller.</li> <li>2. Write programs in assembly language for 8051 to explore its capabilities.</li> <li>3. Program inbuilt peripheral like timer/counter, serial and interrupt peripheral in assembly language.</li> <li>4. Interface devices like LCD, Keypad, DAC, ADC, Stepper motor and PPI 8255 for different</li> </ol>   |                |

applications using assembly language.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1  | 0  | 0  | 0                                | 3 | 0 |
| CO2             | 3                        | 2 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 1  | 1  | 1  | 0                                | 3 | 0 |
| CO3             | 3                        | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3  | 3  | 2  | 0                                | 3 | 0 |
| CO4             | 3                        | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2  | 2  | 2  | 0                                | 3 | 0 |

|                                   |   |                    |
|-----------------------------------|---|--------------------|
| <b>SUBJECT<br/>CODE:21UEC406L</b> | <b>Communication Engineering Laboratory</b> | <b>Credits: 01</b> |
| L:T:P – 0-0-3                     |   | CIE Marks: 50      |
| Total Hours/Week: 03              |   | SEE Marks: 50      |

### LIST OF EXPERIMENTS

1. Design and verification of second order active low pass filter
2. Design and verification of second order active high pass filter
3. Design and verification of second order active band pass filter
4. Design and verification of second order active band elimination filter
5. Realization of Amplitude Modulation (AM) and demodulation for a given modulation index
6. Realization of Frequency Modulation (FM)
7. Realization of Pulse Width Modulation (PWM)
8. Realization of Pulse Position Modulation (PPM)
9. Realization of Pulse Amplitude Modulation (PAM)
10. Realization of Pre-emphasis and De-emphasis circuits
11. Realization of frequency demodulation using PLL
12. Generation of PN sequence

### Course Outcomes\*\*

After completion of the course student will be able to

1. Design and verify the frequency response of active filters for a given specifications.
2. Design and characterize AM and FM modulation and demodulation circuits.
3. Construct pre-emphasis and de-emphasis circuits.
4. Verify the PAM, PWM & PPM circuits.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 2 | 2  | 0  | 1  | 3                                | 0 | 0 |
| <b>CO2</b>      | 3                        | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 2 | 2  | 0  | 1  | 3                                | 0 | 0 |
| <b>CO3</b>      | 3                        | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 2 | 2  | 0  | 1  | 3                                | 0 | 0 |
| <b>CO4</b>      | 3                        | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 2 | 2  | 0  | 1  | 3                                | 0 | 0 |

|  |                                   |                    |
|--|-----------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC407L</b> | <b>Microcontroller Laboratory</b> | <b>Credits: 01</b> |
| L:T:P – 0-0-3                            |                                   | CIE Marks: 50      |
| Total Hours/Week: 03                     |                                   | SEE Marks: 50      |

| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
|--|----------------|
| <ol style="list-style-type: none"> <li>1. Move an 8-bit data byte to a register/memory using all addressing modes.</li> <li>2. Block of data transfer in internal RAM locations.</li> <li>3. Exchange block of data internal/external memory locations.</li> <li>4. Average of n-eight bit numbers.</li> <li>5. Programs on basic arithmetic operations.</li> <li>6. Programs using logical instructions.</li> <li>7. Search a byte in a given array.</li> <li>8. Find largest/smallest number in an array.</li> <li>9. Sorting the given array of numbers in ascending/descending order.</li> <li>10. Code conversion programs.</li> <li>11. Addition/multiplication of two matrices.</li> <li>12. Determine Fibonacci series of a given number.</li> <li>13. Programs on stack operations.</li> <li>14. Programs on serial communication.</li> <li>15. Programs on interrupts.</li> </ol> <p style="text-align: center;"><b>Part-B</b></p> <p><b>Developing interfacing Embedded ‘C’ programs in keil cross-compiler, fusing machine code on flash board/Circuit and testing the code.</b></p> <ol style="list-style-type: none"> <li>1. Stepper motor</li> <li>2. DC motor</li> <li>3. Buzzer</li> <li>4. LCD</li> <li>5. Keypad</li> <li>6. Analog to Digital Conversion (ADC)</li> <li>7. Digital to Analog Conversion (DAC)</li> <li>8. Seven Segment Display (SSD)</li> </ol> |                |

**Course Outcomes\*\***

|  |
|--|
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Conduct experiments to understand fundamental concepts of 8051 microcontroller.</li> <li>2. Write efficient programs in assembly level language of the 8051 microcontroller.</li> <li>3. Write program to interface different peripherals.</li> <li>4. Develop the embedded C program to perform a defined task.</li> </ol> |
|--|

\* Books to be listed as per the format with decreasing level of coverage of syllabus



|  |                       |                    |
|--|-----------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC408T</b> | <b>Internship - I</b> | <b>Credits: 02</b> |
| L:T:P – --                               |                       | CIE Marks: 100     |
| Total Hours/Week: --                     |                       | SEE Marks: --      |

### Course Plan

Each student shall identify current topic relevance to Electronics and Communication Engineering branch, get approval of concern faculty, undergo the domain specific training, study it thoroughly, apply the skills to develop software/hardware module and prepare own report and present in the class individually.

### Course Outcomes\*\*

After completion of the course student will be able to

1. **Demonstrate the skills acquired during the internship**
2. **Develop the small projects (Software/Hardware) by understanding the real time applications.**
3. **Integrate the different modules developed during the internship.**
4. **Develop the technical document for the internship.**

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 1                        | 1 | 2 |   | 3 |   | 1 |   |   |    |    | 2  | 1                                | 2 | 3 |
| CO2             | 3                        | 3 | 2 |   | 3 |   | 2 |   |   |    |    | 2  | 1                                | 1 | 2 |
| CO3             | 3                        | 3 | 2 |   | 3 |   | 3 |   | 1 | 3  |    | 2  | 1                                | 1 | 1 |
| CO4             | 1                        | 1 | 1 |   | 3 |   | 2 |   | 1 | 3  |    | 2  | 2                                | 1 | 1 |

|                                    |                                     |                    |
|------------------------------------|-------------------------------------|--------------------|
| <b>SUBJECT CODE:<br/>21UMA400M</b> | <b>Bridge Course Mathematics-II</b> | <b>Credits: --</b> |
| L:T:P – 3-0-0                      |                                     | CIE Marks: 50      |
| Total Hours/Week: 03               |                                     | SEE Marks: 50      |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Differential Equations-1: Ordinary differential equations of first order: Variable separable, Homogeneous. Exact form and reducible to exact differential equations. Linear and Bernoulli's equation.  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| Differential Equations-2: Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters (second order); Cauchy's and Legendre homogeneous equations.  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| Laplace Transform: Introduction, Definition of Laplace Transform, Laplace Transform of standard functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| Inverse Laplace transforms: Properties, Convolution theorem, Solutions of linear differential equations  |                |
| <b>Reference Books *</b>   |                |
| <b>Text Book:</b>  |                |
| <ol style="list-style-type: none"> <li>1. SB.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.</li> <li>2. Erwin Kreyszing's Advanced Engineering Mathematics volume I and volume II, Wiley India Pvt.Ltd., 2014.</li> <li>3. H K Das, Higher Engineering Mathematics</li> </ol>   |                |
| <b>Reference Books:</b>  |                |
| <ol style="list-style-type: none"> <li>1. Erwin Kreyszing's Advanced Engineering Mathematics, Wiley India Pvt.Ltd., 2014.</li> <li>2. Elementary Differential Equations by Earl D. Rainville and Phillip E. Bedient, Sixth Edition.</li> </ol>   |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b>  |                |
| <ol style="list-style-type: none"> <li>1. Solve first order differential equations of certain types and interpret the solutions.</li> <li>2. Solve second and higher order linear differential equations.</li> <li>3. Apply Laplace transforms for standard functions and its properties</li> <li>4. Apply Inverse Laplace transforms for standard functions</li> <li>5. Apply Inverse Laplace transforms for solve differential equations.</li> </ol> |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

|                        |                                 |   |
|------------------------|---------------------------------|---|
| <b>Course Outcomes</b> | <b>Programme Outcomes (POs)</b> | <b>Program Specific Outcomes (PSOs)</b> |
|------------------------|---------------------------------|---|



|            | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>1</b> | <b>2</b> | <b>3</b> |
|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|----------|----------|----------|
| <b>CO1</b> | 1        | 2        | --       | --       | --       | --       | --       | --       | --       | --        | --        | --        |          |          |          |
| <b>CO2</b> | 1        | 2        | --       | --       | --       | --       | --       | --       | --       | --        | --        | --        |          |          |          |
| <b>CO3</b> | 1        | --       | --       | --       | --       | --       | --       | --       | --       | --        | --        | --        |          |          |          |
| <b>CO4</b> | 1        | --       | --       | --       | --       | --       | --       | --       | --       | --        | --        | --        |          |          |          |

**Syllabus for**  
**B.E. V & VI – Semester**  
**(For students admitted to I year in 2021-22)**

|  |                                  |                    |
|--|----------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC501C</b> | <b>Digital Signal Processing</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |                                  | CIE Marks: 50      |
| Total Hours/Week: 03                     |                                  | SEE Marks: 50      |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms, properties: multiplication of two DFTs, circular convolution and additional properties of DFT. Application of DFT in linear filtering: overlap add and overlap save method.   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| Fast Fourier Transform Algorithms: Need for efficient computation of DFT, Radix 2 FFT algorithms for computation of DFT and IDFT: Decimation in time and decimation in frequency algorithms. Goertzel algorithm and chirp-Z transform algorithm.   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters. Design of IIR filters from analog filters (i.e. Butterworth and Chebyshev), Transformation techniques: Impulse invariance method, Approximation of derivative (Backward difference and Forward difference) method. Bilinear transformation method.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| FIR filter design: Introduction to FIR filters, Design of FIR filters using windowing (Rectangular, Hamming, Hanning and Bartlet) method, FIR filter design using frequency sampling method. Implementation of discrete time systems - Structures for IIR and FIR systems: Direct form I, Direct form II, Cascade and Parallel realization.  |                |
| <b>Reference Books *</b>   |                |
| <b>Textbook:</b> <ol style="list-style-type: none"> <li>Proakis and Manolakis, “Digital Signal Processing-Principles Algorithms and Applications” PHI Publication, III Edition, 1997.</li> </ol> <b>Reference Books:</b> <ol style="list-style-type: none"> <li>Oppenheim and Schaffer, “Discrete Time Signal Processing” PHI Publication, III Edition, 2003.</li> </ol>   |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b> <ol style="list-style-type: none"> <li>Compute and use DFT for linear filtering applications.</li> <li>Calculate DFT and IDFT using FFT and IFFT algorithms.</li> <li>Design IIR filters using Butterworth and Chebyshev approximations and draw their structures.</li> <li>Design FIR filters using windowing and frequency sampling techniques and draw their structures.</li> </ol> |                |

**\* Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| <b>Course Outcomes</b> | <b>Programme Outcomes (POs)</b> |          |          |          |          |          |          |          |          |           |           |           | <b>Program Specific Outcomes (PSOs)</b> |          |          |
|------------------------|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|---|----------|----------|
|                        | <b>1</b>                        | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>1</b>                                | <b>2</b> | <b>3</b> |
| <b>CO1</b>             | 3                               | 2        | 1        | 0        | 1        | 0        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO2</b>             | 3                               | 3        | 1        | 0        | 1        | 0        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO3</b>             | 3                               | 3        | 3        | 0        | 1        | 0        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO4</b>             | 3                               | 2        | 3        | 0        | 1        | 0        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |

|  |                            |                    |
|--|----------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC502C</b> | <b>Control Engineering</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |                            | CIE Marks: 50      |
| Total Hours/Week: 03                     |                            | SEE Marks: 50      |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>xx Hrs.</b> |
| System modeling: Definition of control system, Concept of feedback and its significance, open loop and closed loop systems, Modeling of Electrical, Mechanical and Electromechanical systems, Differential equations of physical system. Transfer function, Block diagram representation and Reduction technique, Signal flow graph representation and reduction using Mason's gain formula. |                |

|  |                |
|--|----------------|
| <b>UNIT-II</b>   | <b>xx Hrs.</b> |
| Time domain analysis of control systems: Introduction, standard test signals, Unit step response of a second order system, Steady state error analysis, time domain specifications. Stability analysis technique: Concept of stability, Location of Roots in the s-plane for stability, methods of determining stability, Routh-Hurwitz stability criterion. |                |

|  |                |
|--|----------------|
| <b>UNIT-III</b>  | <b>xx Hrs.</b> |
| Root-Locus Technique: Introduction, Procedure for constructing Root-locus. Stability analysis using root locus. Frequency Domain Analysis: Introduction, Bode plots, Gain and Phase cross over frequency, gain margin, phase margin, Frequency domain specifications-resonant peak, resonant frequency, and bandwidth. |                |

|  |                |
|--|----------------|
| <b>UNIT-IV</b>   | <b>xx Hrs.</b> |
| Polar plots, Nyquist stability criterion; Principle of argument, mapping, Nyquist path, Nyquist criterion, Nyquist Plot and stability analysis. State Space Analysis: Introduction, concept of state and variables, state model, Non homogeneous solution of a state equation. |                |

|  |
|--|
| <b>Reference Books *</b>   |
| <ol style="list-style-type: none"> <li>1. Nagrath and Gopal, "Control System Engineering", New Age publication.</li> <li>2. K. Ogeta, "Modern control engineering", Person education, Asia/PHI 4<sup>th</sup> edition, 2002.</li> <li>3. Benjamin C.Kuo, "Automatic Control Systems", PHI 7<sup>th</sup> edition.</li> <li>4. Richard C. Dorf and Robert. H. Bishop, "Modern Control Systems", Person Education, 8<sup>th</sup> Edition, 2002.</li> <li>5. M. Gopal, "Control Systems-Principles and Design", TMH, 2nd Edition, 2002.</li> <li>6. David. K. Chng, "Analysis of Linear systems", Narosa publishing house, 1996</li> </ol> |

|   |
|---|
| <b>Course Outcomes**</b>  |
| <b>After completion of the course student will be able to</b>   |
| <ol style="list-style-type: none"> <li>1. Mathematically model electrical, mechanical and electromechanical control systems.</li> <li>2. Characterize the control systems in time domain.</li> <li>3. Analyze stability of a control system using root locus technique and frequency domain analysis using Bode plotting techniques.</li> <li>4. Determine the stability of control systems using polar and Nyquist plotting technique and represent the control systems using state space techniques.</li> </ol> |

\* Books to be listed as per the format with decreasing level of coverage of syllabus  
 \*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 2 | - | 2 | 2 | - | - | - | -  | -  | -  |                                  |   |   |
| CO2             | 3                        | 2 | 3 | - | 2 | 1 | - | - | - | -  | -  | -  |                                  |   |   |
| CO3             | 3                        | 2 | 3 | - | 3 | - | - | - | 1 | -  | -  | -  |                                  |   |   |
| CO4             | 2                        | 1 | 1 | - | 2 | 1 | - | - | 1 | -  | -  | 1  |                                  |   |   |

|  |                                 |                    |
|--|---------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC503C</b> | <b>CMOS Digital VLSI Design</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |                                 | CIE Marks: 50      |
| Total Hours/Week: 03                     |                                 | SEE Marks: 50      |

|   |                |
|---|----------------|
| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| <p><b>Introduction:</b> A Brief History, Preview, MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, Design Partitioning. <b>MOS Transistor Theory:</b> Introduction, Long- Channel I-V Characteristics, C-V Characteristics (simple MOS capacitance models), Non ideal I-V Effects, DC Transfer Characteristics. <b>CMOS Processing Technology:</b> Introduction, CMOS Technologies.</p>  |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| <p><b>Delay:</b> Introduction, Transient Response, RC Delay Model, Linear Delay Model (Logical effort, parasitic delay, delay in logic gate, drive), Logical Effort of Paths, <b>Power:</b> Introduction, Dynamic Power, Static Power.</p>  |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| <p><b>Interconnect:</b> Introduction (wire Geometry), Interconnect Modeling, Interconnect Impact (Delay, Energy, Cross talk). <b>Combinational Circuit Design:</b> Introduction, Circuit families, Silicon-On-Insulator Circuit Design.</p>   |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| <p><b>Sequential Circuit Design:</b> Introduction, Circuit Design of Latches and Flip Flops (conventional CMOS latches, conventional CMOS flip flops, pulsed latches, resettable latches and flip flops, enabled latches and flip flops, incorporating logic into latches, dual edge triggered flip flops. <b>Array Subsystems:</b> Introduction, SRAM (SRAM cells, ROW circuitry, column circuitry), Read-Only Memory, Serial Access Memories, Content Addressable Memory, Programmable Logic Arrays.</p>  |                |
| <b>Reference Books *</b>  |                |
| <p><b>Text Book:</b></p> <ol style="list-style-type: none"> <li>Neil H. E. Weste, David Harris “CMOS VLSI Design A Circuits and Systems Perspective”</li> <li>Pearson Education Publisher, Fourth Edition, 2015.</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic “Digital Integrated Circuits A Design Perspective” Pearson Education Publisher, Second Edition. 2010.</li> <li>John P Uyemura “Introduction to VLSI Circuits and Systems” Wiley Publication 2002.</li> <li>R. Jacob Baker, Harry W. Li and David E Boyce “CMOS Circuit Design, Layout, and Simulation”</li> </ol> |                |
| <b>Course Outcomes**</b>  |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li><b>Draw the layout of CMOS circuits; apply the knowledge of fabrication processes and MOSFET transistors in VLSI design.</b></li> </ol>   |                |

2. Draw RC equivalent circuit of CMOS circuits and estimate delay and power.
3. Model & design of interconnects in chips, design of combinational circuits.
4. Design basic buildings of sequential and memory blocks using MOSFET transistors.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 1 | 0 |
| <b>CO2</b>      | 3                        | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 2 | 0 |
| <b>CO3</b>      | 3                        | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 2 | 0 |
| <b>CO4</b>      | 3                        | 3 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0  | 0  | 0  | 3                                | 2 | 0 |



|  |                                     |                    |
|--|-------------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC504L</b> | <b>CMOS Digital VLSI Laboratory</b> | <b>Credits: 01</b> |
| L:T:P – 0-0-3                            |                                     | CIE Marks: 50      |
| Total Hours/Week: 03                     |                                     | SEE Marks: 50      |

| NAME OF THE EXPERIMENT   |
|--|
| <p>Design following CMOS/TG based circuits with given specifications* and complete the VLSI design flow mentioned below using appropriate tool:</p> <ol style="list-style-type: none"> <li>a) Draw the schematic and verify the following               <ol style="list-style-type: none"> <li>i) DC Analysis ii) Transient Analysis</li> </ol> </li> <li>b) Draw the Layout and verify the DRC,ERC</li> <li>c) Check for LVS</li> <li>d) Extract RC and back annotate the same and verify the design.</li> </ol><br><ol style="list-style-type: none"> <li>1) CMOS inverter</li> <li>2) CMOS two input NAND gate</li> <li>3) CMOS two input NOR gate</li> <li>4) CMOS two input OR gate</li> <li>5) CMOS two input AND gate</li> <li>6) TG based two input XOR and XNOR gates</li> <li>7) Negative edge triggers D flip flop using TGs and inverters</li> <li>8) 4:1 MUX using TGs and inverters</li> <li>9) 3- Bit up counter</li> <li>10) 3-Bit SISO shift register</li> </ol> <p><i>*An appropriate constraint should be given</i></p> |
| <b>Course Outcomes**</b>   |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Design CMOS/ TG based gates, MUX, flipflops, counters and shift register.</li> <li>2. Draw the layout, run DC and transient analysis for designed CMOS standard cells.</li> </ol>   |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 1                        | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO2</b>      | 1                        | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

|  |                         |                   |
|--|-------------------------|-------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC505E</b> | <b>JAVA Programming</b> | <b>Credits:03</b> |
| L:T:P – 3-0-0                            |                         | CIE Marks: 50     |
| Total Hours/Week: 03                     |                         | SEE Marks: 50     |

| <b>UNIT-I</b>  | <b>xx Hrs.</b> |
|--|----------------|
| <p>Introducing classes, Objects and Methods: Introducing Classes, Class Fundamentals, The GeneralForm of a Class, A Simple Class, Declaring Objects, A Closer Look at new, Assigning Object Reference Variables, Introducing Methods, Adding a Method to the Box Class, Returning a Value, Adding a Method That Takes Parameter , Constructors, Parameterized Constructors, The this Keyword, The finalize( ) Method, A Stack Class. A Closer Look at Methods and Classes : Overloading Methods , Overloading Constructors, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Introducing Nested and Inner Classes, Exploring the String Class, Using Command Line Arguments.</p> |                |
| <b>UNIT-II</b>   | <b>xx Hrs.</b> |
| <p>Inheritance: Inheritance, Inheritance Basics, Member Access and Inheritance, Example, A Super class Variable Can Reference a Subclass Object, Using super, Using super to Call Super class Constructors, A Second Use for super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Why Overridden Methods?, Applying Method Overriding. Using Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding, Using final to Prevent Inheritance, The Object Class. Packages and Interfaces: Packages, Defining a Package, Finding Packages and CLASS PATH, A Short Package Example, Access Protection, An Access Example, Importing Packages, Interfaces, Defining an Interface, Implementing Interfaces, Nested Interfaces.</p>     |                |
| <b>UNIT-III</b>  | <b>xx Hrs.</b> |
| <p>Exception Handling : Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Displaying a Description of an Exception, Multiple catch Clauses , Nested try Statements, throw, throws, finally, Java’s Built-in Exceptions , Creating Your Own Exception Subclasses, Using Exceptions . Multithreaded Programming : The Java Thread Model, Thread Priorities, Synchronization, Messaging, The Thread Class and the Runnable Interface, The Main Thread, Creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple Threads, Using is Alive( ) and join( ).</p>  |                |
| <b>UNIT-IV</b>   | <b>xx Hrs.</b> |
| <p>Multithreaded Programming Continuous: Thread Priorities, Inter thread Communication, Deadlock, Suspending, Resuming, and Stopping Threads, Suspending, Resuming, and Stopping Threads. The Applet Class :Two Types of Applets, Applet Basics, The Applet Class, Applet Architecture, An Applet Skeleton, Applet Initialization and Termination, Overriding update( ), Simple Applet Display Methods, A Simple Banner Applet, Using the Status Window, The HTML APPLET Tag, Passing Parameters to Applets, get Document Base( ) and get Code Base( ), Applet Context and show Document( ), The Applet Stub Interface .</p>   |                |
| <b>Reference Books *</b>   |                |

1. From Complete Reference, “The Complete Reference” 7th edition
2. E. Balagurusamy, “Program with JAVA” 4th edition
3. Herbert Schildt, Dale Skrien, “Java Fundamentals A Comprehensive Introduction” McGraw Hill
4. The JAVA tutorials, 4th Edition by SUN Microsystems

### Course Outcomes\*\*

After completion of the course student will be able to

1. Use fundamentals of class, objects, methods, operators, constructors.
2. Write programs using Inheritance, Super class, methods overriding, object class, final key, packages & interfaces in java code.
3. Handling Exceptions fundamentals, exception hierarchy, exception JAVA Programming fundamentals & Multithreaded Programming concepts.
4. Establish Inter thread communication, set thread priorities, solve deadlock , operations of suspend(),resume(), Stop(). Programming for applets.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0  | 0  | 1  | 2                                | 0 | 2 |
| CO2             | 3                        | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0  | 0  | 2  | 2                                | 0 | 2 |
| CO3             | 3                        | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0  | 0  | 3  | 2                                | 0 | 2 |
| CO4             | 3                        | 2 |   | 0 | 0 | 1 | 2 | 0 | 0 | 0  | 0  | 3  | 2                                | 0 | 2 |

|  |  |                    |
|--|--|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC506E</b> | <b>Digital System Design using Verilog</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |  | CIE Marks: 50      |
| Total Hours/Week: 03                     |  | SEE Marks: 50      |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <p><b>Introduction to Verilog:</b> Introduction, Computer-Aided Design, Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, Constants, Arrays,</p>   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p><b>Introduction to Verilog cont.:</b> Loops in Verilog, Testing a Verilog Model.<br/> <b>Design Examples:</b> Introduction, BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller, State Graphs for Control Circuits, Scoreboard and Controller, Synchronization and De-bouncing, A Shift-and-Add Multiplier, Array Multiplier, A Signed Integer/Fraction Multiplier, Keypad Scanner, Binary Dividers.</p>   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p><b>Additional Topics in Verilog:</b> Introduction, Verilog Functions, Verilog Tasks, Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM model, Model for SRAM Read/Write System, Rise and Fall Delays of Gates, Named Association, Generate Statements, System Functions, Compiler Directives, File I/O Functions, Timing Checks.<br/> <b>Hardware Testing and Design for Testability:</b> Introduction, Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Built-In Self-Test.</p>   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p><b>Component Test and Verification:</b> Test-bench, Combinational circuit testing, Sequential circuit testing, Test-bench Techniques, Simulation control, Limiting data sets, Applying synchronized data, Synchronized display of results, An interactive test-bench, Random time intervals, Buffered data application, Design Verification, Assertion Verification, Assertion verification benefits, Open verification library, Using assertion monitors, Assertion templates</p>  |                |
| <b>Reference Books *</b>   |                |
| <ol style="list-style-type: none"> <li>1) Charles Roth, Lizy Kurian John, and ByeongKil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016</li> <li>2) Zainalabedin Navabi "Verilog Digital System Design" Second Edition, Mcgraw Higher Ed,2008</li> <li>3) Palnitkar, Samir. "Verilog HDL: a guide to digital design and synthesis" Vol. 1. Prentice Hall Professional,2003.</li> <li>4) Sagdeo, Vivek. "The complete Verilog book". Springer Science &amp; Business Media,2007.</li> <li>5) Smith, Douglas J., and Alex Foreword By-Zamfirescu. "HDL Chip Design: A practical guide for designing, synthesizing and simulating ASICs and FPGAs using VHDL or Verilog" Doone Publications,1998.</li> <li>6) Bhasker, Jayaram. "A Verilog HDL Primer". Star Galaxy Publishing,1999.</li> </ol> |                |
| <b>Course Outcomes**</b>   |                |



|   |                              |                    |
|---|------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC507E</b>                            | <b>Mobile Communications</b> | <b>Credits: 03</b> |
| L:T:P - N <sub>L</sub> :02 N <sub>T</sub> :00<br>N <sub>P</sub> :00 |                              | CIE Marks: 50      |
| Total Hours/Week: 02  |                              | SEE Marks: 50      |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Wireless standard organizations. Wireless transmission: Frequencies for radio communication, signals, antennas, signal propagation. Medium access control: Motivation for specialized MAC, SOMA, FDMA, TOMA, CDMA.   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| Telecommunication systems: GSM, UMTS and IMT2000, 4GLTE networks, 5G networks over view. Broadcast system: Overview, cyclical repetition of data, digital audio broadcasting, and digital video broadcasting.  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| Wireless LAN: IEEE802.11 system architecture, protocol architecture, physical layer, medium access controller, MAC management. 802.11b. and 802.11a. Bluetooth: user scenarios, architecture, radio layer.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| Mobile network layer dynamic host configuration protocol, mobile Ad-hoc network. Mobile transport layer: Traditional TCP , classical TCP improvement, TCP over2.5/3G wireless network, performance enhancing proxies.  |                |
| <b>Reference Books *</b>   |                |
| <ol style="list-style-type: none"> <li>1. Jochen Schiller, 2003 "Mobile Communications", second edition PearsonEducation.</li> <li>2. Gary Mullett, 2006 "Introduction to wireless telecommunication systems and networks ", First Edition Cengage learning</li> </ol>   |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b> <ol style="list-style-type: none"> <li>1. identify the different mobile accessing techniques.</li> <li>2. Identify the different architecture of mobile communications</li> <li>3. Design and develop the different configurations of LAN systems.</li> <li>4. Develop different network layer and transport layer protocols.</li> </ol> |                |

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 2                        | - | 2 | - | 3 | - | - | 1 | - | 1  | -  | 1  | 1                                | 0 | 3 |
| <b>CO2</b>      | 2                        | - | 2 | - | 3 | - | - | 1 | - | 1  | -  | 1  | 1                                | 0 | 3 |
| <b>CO3</b>      | 2                        | - | 3 | - | 2 | - | - | 1 | - | 1  | -  | 1  | 1                                | 0 | 3 |
| <b>CO4</b>      | 2                        | - | 3 | - | 3 | - | - | 1 | - | 1  | -  | 1  | 1                                | 0 | 3 |

|                                   |                              |                    |
|-----------------------------------|------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC535N | <b>Communication Systems</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                     |                              | CIE Marks: 50      |
| Total Hours/Week: 03              |                              | SEE Marks: 50      |

| <b>UNIT-I</b>   | <b>xx Hrs.</b> |
|---|----------------|
| <p><b>Introduction to Communication Systems:</b> Elements of Communication Systems, Need for Modulation, Electromagnetic Spectrum and typical applications, Terminologies in communication systems.</p> <p><b>Amplitude Modulation Techniques:</b> Elements of analog communication, Theory of amplitude modulation techniques, Generation of amplitude modulated signals.</p>  |                |
| <b>UNIT-II</b>  | <b>xx Hrs.</b> |
| <p><b>Angle Modulation Techniques:</b> Theory of angle modulation techniques, Frequency modulation, Practical issues in frequency modulation, Comparison of FM and AM, Generation of frequency modulation: Transistor reactance modulator, Varactor diode modulator, Stabilized reactance modulator-AFC.</p> <p><b>Pulse Modulation Techniques:</b> Introduction, Pulse analog modulation techniques, Pulse digital modulation techniques</p> |                |
| <b>UNIT-III</b>   | <b>xx Hrs.</b> |
| <p><b>Digital Modulation Techniques:</b> Introduction, Basic digital modulation schemes, M-ary digital modulation techniques.</p> <p><b>Radio Transmitters and Receivers:</b> Introduction to radio communication, Radio transmitters: AM Transmitters, SSB Transmitters, FM Transmitters, Superheterodyne receiver, Single and Independent Side Band Receivers, Slope detection, stereo FM multiplex reception</p>                           |                |
| <b>UNIT-IV</b>  | <b>xx Hrs.</b> |
| <p><b>Broadband Communication Systems:</b> Multiplexing, Short and medium haul systems, Long haul systems.</p> <p><b>Introduction to Fiber Optic Technology:</b> History of fiber optics, introduction to light, The Optical fiber and fiber cables, Fiber optic components and systems.</p>  |                |
| <b>Reference Books *</b>  |                |
| <ol style="list-style-type: none"> <li>1. George Kennedy, Bernard Davis, S R M Prasanna, “Electronic Communication Systems”, Tata McGraw Hill Education Private Limited, New Delhi, 5<sup>th</sup> Edition</li> <li>2. B. P. Lathi, Zhi Ding, “Modern Digital and Analog Communication Systems”, Oxford University Press, 4<sup>th</sup> Edition, 2010</li> <li>3. Simon Haykin, “Digital communications”, John Wiley, 2014</li> </ol>        |                |
| <b>Course Outcomes**</b>  |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Understand and analyze communication systems and amplitude modulation techniques.</li> <li>2. Visualize angle and pulse modulation systems.</li> <li>3. Explain different digital communication systems and radio transmitters/receivers.</li> <li>4. Categorize broadband and optical fiber communication systems.</li> </ol> |                |

**\* Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO2</b>      | 3                        | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO3</b>      | 3                        | 3 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO4</b>      | 2                        | 2 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |



|                                   |   |                    |
|-----------------------------------|---|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC532N | <b>Digital Electronics and Microcontrollers</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                     |   | CIE Marks: 50      |
| Total Hours/Week: 03              |   | SEE Marks: 50      |

|   |                |
|---|----------------|
| <b>UNIT-I</b>   | <b>xx Hrs.</b> |
| Combinational Logic Circuits: Definition of combinational circuit, design procedure, half adder, full adder, half subtractor, full subtractor, parallel adder, decoder, encoder, comparator (1& 2 bit), multiplexer, demultiplexer. |                |

|  |                |
|--|----------------|
| <b>UNIT-II</b>   | <b>xx Hrs.</b> |
| Microprocessors and Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, Z80 and 8051, 4-bit to 32-bit microcontrollers. 8051 Architecture: General features of 8051 Microcontroller, 8051 block diagram, programming model, pin description, 8051 oscillator and clock, general purpose and special function registers, internal RAM and ROM, stack, input/output pins, basics of input output port |                |

|  |                |
|--|----------------|
| <b>UNIT-III</b>  | <b>xx Hrs.</b> |
| 8051 Instructions and Programming: addressing modes, types of instructions, instruction set, and data move instructions, external data move instructions, arithmetic instructions, logical instructions, jump and call instructions, bit-addressable instructions, programs using all the above instructions and concepts. |                |

|  |                |
|--|----------------|
| <b>UNIT-IV</b>   | <b>xx Hrs.</b> |
| Programming peripherals in assembly: Timer and counter programming (mode 1). Serial Port Programming: Basics of serial communication, 8051 serial port programming. Interrupts: 8051 interrupts, Programming timer interrupts. |                |

#### Reference Books \*

1. Donald D Givone, "Digital principle and design", Tata McGraw Hill edition, 2002
2. Kenneth J. Ayala, "The 8051 Micro controller Architecture, Programming & Applications", Penram International, 2nd Edition, 1996
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, "The 8051 Micro controller and Embedded Systems", Pearsons Education, 2<sup>nd</sup> edition, 2007. John M Yarbrough, "Digital logic applications and design", Thomson learning, 2001.
4. Thomas L. Floyd, "Digital fundamentals", 9<sup>th</sup> edition, PHI.
5. Dr. Uma Rao and Dr. Andhe Pallavi, "The 8051 microcontroller architecture, programming and applications", Pearson Education, 2010.
6. David Calcutt, Fredcwon, "8051 microcontroller", Elsevier, 1<sup>st</sup> Edition, 2004.

#### Course Outcomes\*\*

**After completion of the course student will be able to**

1. **Proficient in defining, classifying, and analyzing combinational circuits and demonstrate the ability to design and implement various basic combinational circuits effectively.**
2. **Acquire a comprehensive understanding of microprocessors and microcontrollers and capable of analyzing the architecture and general features of the 8051 microcontroller, including its programming model, pin description, oscillator, clock, registers, and memory organization.**

3. **Develop programming skills in writing assembly programs that involve data manipulation, arithmetic operations, logical functions, jump, call instructions, and bit- addressable instructions.**
4. **Gain expertise in programming timers and counters for timekeeping and event counting, serial port communication, enabling data transmission and reception in various applications and handling interrupts for event-driven programming.**

**\* Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |  |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|--|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |  |
| <b>CO1</b>      | 3                        | 2 | 1 |   | 1 | 1 | 1 |   |   |    |    |    |                                  | 3 |   |  |
| <b>CO2</b>      | 3                        | 2 | 1 |   | 1 | 1 | 1 |   |   |    |    |    |                                  | 3 |   |  |
| <b>CO3</b>      | 3                        | 2 | 2 |   | 2 | 2 | 1 | 2 | 1 | 1  | 1  | 2  |                                  | 3 |   |  |
| <b>CO4</b>      | 3                        | 2 | 2 |   | 2 | 1 | 1 | 2 | 1 | 1  | 1  | 2  |                                  | 3 |   |  |

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION  
ENGINEERING**

**Outcome Based Education (OBE) and Choice Based  
Credit System (CBCS)  
SEMESTER – VII  
Internship**

|                             |           |           |                |
|-----------------------------|-----------|-----------|----------------|
| Course Code:                | 21UEC510I | CIE Marks | 70             |
| Teaching Hours/Week (L:T:P) | --        | SEE Marks | 30             |
| Credits                     | 02        | Hours     | 30 Min/Student |

**I. Internship:**

Students need to meet following criteria to successfully complete the internship course.

**II. Course objectives:**

This objective of the course are

- Enhance student's knowledge of a particular area(s) of Electronics and Communication Engineering.
- Experience integration of theory and practice existing in IT Industries.
- Develop systematic work culture and skills necessary for successful professional career.
- Build the abilities such as working in diverse areas, self learning, lifelong learning and technical documentation and reporting.

**III. Components of Internship**

**1. Student's Diary/ Daily Log**

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated based on the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches, and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

**2. Internship Report**

The Internship report will be evaluated based on following criteria:

- Originality.
- Internship certificate from the industry.
- Adequacy and purposeful write-up.

- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course

#### **IV. Course outcomes:**

After completion of the course the student will be able to:

1. Demonstrate the skills gained during the internship at the industry, through simulation/actual implementation.
2. Solve simple real time problems associated in their field of internship.
3. Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.
4. Document and present technical matter to fellow colleagues effortlessly.

#### **V. Evaluation:**

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.
2. Evaluation through seminar presentation
3. Viva-voce at the Institute.

#### **Evaluation Through Seminar Presentation/Viva-Voce at The Institute**

The student has to give a seminar based on his/her training, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analysed along with the Internship Report

## Evaluation Criteria

| <b>Summary of Internship Evaluation</b>                           |              |
|---|--------------|
| <b>Guide at the Industry</b>                                      |              |
| <b>Evaluation Criteria</b>  | <b>Marks</b> |
| Quality of Work   | 10           |
| Ability to Learn  | 10           |
| Initiative and Creativity   | 10           |
| Character Traits  | 10           |
| Dependability   | 10           |
| Organizational Fit  | 10           |
| Response to Supervision   | 10           |
| <b>Total (A)</b>  | <b>70</b>    |
| <b>Department Committee(Faculty Advisor+External+HoD/Nominee)</b> |              |
| Demonstration of experience                                       | 10           |
| Report  | 10           |
| Presentation  | 10           |
| <b>Total (B)</b>  | <b>30</b>    |
| <b>Total Score (A+B)</b>  | <b>100</b>   |

**Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

| No                                   | Programme Outcomes   | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|--------------------------------------|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
|                                      | Course Outcomes  |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |
| <b>The students will be able to:</b> |  |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |
| 1                                    | Demonstrate the skills gained during the internship at the industry, through simulation/actual implementation. | 3    | 2    | 2    | 2    | 3    | 3    | 3    | 1    | 3    | 3     | 3     | 3     | 1     | 1     | 1     |
| 2                                    | Solve simple real time problems associated in their field of internship.                                       | 3    | 2    | 2    | 2    | 3    | 3    | 3    | 1    | 3    | 3     | 3     | 3     | 1     | 1     | 1     |
| 3                                    | Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.           | 3    | 2    | 2    | 2    | 3    | 3    | 3    | 1    | 3    | 3     | 3     | 3     | 1     | 1     | 1     |
| 4                                    | Document and present technical matter to fellow colleagues effortlessly.                                       | 3    | 2    | 2    | 2    | 3    | 3    | 3    | 1    | 3    | 3     | 3     | 3     | 1     | 1     | 1     |

### Evaluation of Internship – Grading Rubrics for Industry

| Evaluation Dimensions                               | Performance Rating   |   |  | Maximum Score |
|---|--|---|--|---------------|
|   | Needs Improvement  | Meets Expectations  | Excellent  |               |
|   | 0-4  | 5-7   | 8-10   |               |
| Internship Evaluation Dimensions – Grading Criteria |  |   |  |               |
| <b>Quality of Work</b>                              | Work was done in a careless manner and was of erratic quality;<br>Work assignments were usually late and required review;<br>Made numerous errors  | With a few minor exceptions, adequately performed most work requirements; Most work assignments submitted in a timely manner; Made occasional errors  | Thoroughly and accurately performed all work requirements;<br>Submitted all work assignments on time;<br>Made few if any errors  | 10            |
| <b>Ability to Learn</b>                             | Asked few questions and rarely sought out additional information<br>Unable or slow to understand new concepts, ideas, and work assignments;<br>Unable or unwilling to recognize mistakes and was not receptive to making needed changes and improvements | Asked relevant questions and sought out additional information from appropriate sources;<br>Acceptable understanding of new concepts, ideas, and work assignments;<br>Willing to take responsibility for mistakes and to make needed changes and improvements | Consistently asked relevant questions and sought out additional information from appropriate sources;<br>Quickly understood new concepts, ideas, and work assignments;<br>Always willing to take responsibility for mistakes and to make needed changes and improvements | 10            |

|   |  |  |   |           |
|---|--|--|---|-----------|
| <p><b>Initiative and Creativity</b></p> | <p>Had little observable drive and required close supervision;<br/>         Showed little interest in meeting standards;<br/>         Did not seek out additional work and frequently procrastinated in completing assignments;<br/>         suggested no new ideas or options</p>                     | <p>Worked without extensive supervision;<br/>         Found problems to solve and sometimes asked for additional work assignments;<br/>         Set his/her own goals and, tried to exceed requirements;<br/>         offered some creative ideas</p>  | <p>A self-starter;<br/>         Consistently sought new challenges and asked for additional work assignments;<br/>         Regularly approached and solved problems independently;<br/>         Frequently proposed innovative and creative ideas, solutions, and/or options</p>    | <p>10</p> |
| <p><b>Character Traits</b></p>          | <p>Regularly exhibited a negative attitude;<br/>         Dishonest and/or showed a lack of integrity on several occasions;<br/>         Unable to recognize and/or was insensitive to ethical and diversity issues;<br/>         Displayed significant lapses in ethical and professional behavior</p> | <p>Except in a few minor instances, demonstrated a positive attitude;<br/>         Regularly exhibited honesty and integrity in the workplace;<br/>         Usually aware of and sensitive to ethical and diversity issues on the job;<br/>         Normally behaved in an ethical and professional manner</p> | <p>Exceptionally positive attitude;<br/>         Consistently exhibited honesty and integrity in the workplace;<br/>         Keenly aware of and deeply sensitive to ethical and diversity issues on the job;<br/>         Always behaved in an ethical and professional manner</p> | <p>10</p> |



| Evaluation Dimensions                               | Performance Rating   |   |   | Maximum Score |
|---|--|---|---|---------------|
|   | Needs Improvement  | Meets Expectations  | Excellent   |               |
|   | 0-4  | 5-7   | 8-10  |               |
| Internship Evaluation Dimensions – Grading Criteria |  |   |   |               |
| <b>Dependability</b>                                | Generally unreliable in completing work assignments; Did not follow instructions and procedures promptly or accurately; Careless, and work needed constant follow-up; required close supervision | Generally reliable in completing tasks; Normally followed instructions and procedures; Usually attentive to detail, but work had to be reviewed occasionally; Functioned with only moderate supervision | Consistently reliable in completing work assignments; Always followed instructions and procedures well; Careful and extremely attentive to detail; Required little or minimum supervision | 10            |

|                                       |  |   |  |           |
|---------------------------------------|--|---|--|-----------|
| <p><b>Organizational Fit</b></p>      | <p>Unwilling or unable to understand and support the organization’s mission, vision, and goals;<br/>Exhibited difficulty in adapting to organizational norms, expectations, and culture;<br/>Frequently seemed to disregard appropriate authority and decision-making channels</p> | <p>Adequately understood and supported the organization’s mission, vision, and goals;<br/>Satisfactorily adapted to organizational norms, expectations, and culture;<br/>Generally functioned within appropriate authority and decision-making channels</p> | <p>Completely understood and fully supported the organization’s mission, vision, and goals;<br/>Readily and successfully adapted to organizational norms, expectations, and culture;<br/>Consistently functioned within appropriate authority and decision-making channels</p> | <p>10</p> |
| <p><b>Response to Supervision</b></p> | <p>Rarely sought supervision when necessary;<br/>Unwilling to accept constructive criticism and advice;<br/>Seldom implemented supervisor suggestions;<br/>Unwilling to explore personal strengths and areas for improvement</p>   | <p>Sought supervision when necessary;<br/>Receptive to constructive criticism and advice;<br/>Implemented supervisor suggestions in most cases;<br/>Willing to explore personal strengths and areas for improvement</p>                                     | <p>Actively sought supervision when necessary;<br/>Always receptive to constructive criticism and advice;<br/>Successfully implemented supervisor suggestions when offered;<br/>Always willing to explore personal strengths and areas for improvement</p>                     | <p>10</p> |

**Evaluation of Internship – Grading Rubric for Department Evaluation  
Committee/Faculty**

| Evaluation Dimensions                                      | Performance Rating  |  |   | Maximum Score |
|--|---|--|---|---------------|
|  | Needs Improvement   | Meets Expectations   | Excellent   |               |
|  | 0-4   | 5-7  | 8-10  |               |
| <b>Internship Evaluation Dimensions – Grading Criteria</b> |   |  |   |               |
| <b>Demonstration of experience</b>                         | Offers little in the way of illustrating experiences<br>Fails to adequately address how the experiences relate to the competencies. | Addresses the Activities and experiences, but not so clearly and concisely | Well addressed activities and experiences as well as relating them to the program competencies. | 10            |

|                          |   |   |  |    |
|--------------------------|---|---|--|----|
| <b>Report</b>            | Unedited and difficult to read It is littered with grammatical and typographical errors, demonstrating little effort to producing a quality report. No reference is made to practical application. Lacks evidence and internship experience | Well-written for the most part but still has somewhat detracting errors that could have been fixed with additional editing prior to submission. Key concepts related to the selected evidence and internship experience are inaccurate or incomplete. Some helpful practical applications are included. | Has been carefully edited and is free or nearly free of any grammatical or typographical errors. Well-organized report is easy to read and understand and stands alone as a quality piece of writing. An accurate and complete reflection of key concepts related to the selected evidence and internship experience Practical applications are included to illuminate issues. | 10 |
| <b>Presentati<br/>on</b> | Information is lacking/unclear and communicated in such a way that the audience cannot understand the purpose of the evidence work and internship experiences.  | Information is presented in a clear manner but still lacks practical experience   | Information is communicated in a thorough manner and ideas are expressed in such a way that the audience can clearly understand the evidence work and internship experiences.  | 10 |

|                                   |                              |                    |
|-----------------------------------|------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UBT523C | <b>Environmental Studies</b> | <b>Credits: 01</b> |
| L:T:P – 1-0-0                     |                              | CIE Marks: 50      |
| Total Hours/Week: 01              |                              | SEE Marks: 50      |

|   |                 |
|---|-----------------|
| <b>UNIT-I</b>   | <b>04 Hrs.</b>  |
| <p><b>Natural Resources:</b> Human activities and their impacts. <b>Energy:</b> Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel. <b>Non renewable Energy:</b> Coal, Petroleum, Natural gas, Nuclear energy.</p>  |                 |
| <b>UNIT-II</b>  | <b>04 Hrs.</b>  |
| <p><b>Environmental Pollution:</b> Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves.<br/> <b>Sustainable future:</b> Concept of sustainable development, threats to sustainability, strategies for sustainable development. Environment economics – concept of green building, clean development mechanism (CDM).</p>      |                 |
| <b>UNIT-III</b>   | <b>03 Hrs.</b>  |
| <p><b>Current Environmental Issues of concern: 03 hours</b> Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication, Environmental policy legislation rules &amp; regulations</p>  |                 |
| <b>UNIT-IV</b>  | <b>04 Hrs..</b> |
| <p><b>Fundamentals of Waste management: 04 hours</b> Solid waste management: Sources, classification, characteristics, collection &amp; transportation, disposal, and processing methods. Hazardous waste management and handling. Concept of waste water treatment, Bioremediation, Industrial waste management (Case studies: Cement, plastic, chemical, E-waste, food &amp; construction industry waste management).</p> |                 |
| <b>Reference Books *</b>  |                 |

1. Benny Joseph “Environmental Studies” Tata McGraw Hill, 2005
2. Dr. D. L. Manjunath, “Environmental Studies” Pearson Education, 2006
3. Koushik and Koushik “Environmental Science & Engineering” New Age International Publishers, New Delhi, 2006
4. Meenakshi “Environmental Science & Engineering” Pranticce Hall of India, 2006

|   |
|---|
| <b>Course Outcomes**</b>  |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Ability to recognize natural resources and its uses.</li> <li>2. Able to understand pollution and its effects on environment and to implement sustainable future in the work place.</li> <li>3. Ability to understand current environmental issues.</li> <li>4. Able to apply the waste management techniques in various fields</li> </ol> |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | -                        | 1 | - | - | - | 2 | 3 | - | - | -  | -  | 3  | 1                                | - | - |
| CO2             | 2                        | - | - | - | - | - | 3 | - | - | -  | -  | 3  | 1                                | - | - |
| CO3             | -                        | 2 | - | - | - | 2 | 2 | - | - | -  | -  | 3  | 1                                | - | - |
| CO4             | -                        | - | - | 1 | - | 2 | 2 | 1 | - | -  | -  | 3  | 1                                | - | 1 |

|                                   |  |                      |
|-----------------------------------|--|----------------------|
| <b>SUBJECT CODE:</b><br>21UHS521C | <b>Quantitative Aptitude and Professional Skills</b> | <b>Credit: 02</b>    |
| <b>L:T:P - 2 : 0: 0</b>           |  | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week:02</b>        |  | <b>SEE Marks: 50</b> |

### Course Objectives:

1. To develop and augment written English language vocabulary and comprehension skills
2. To augment the ability to understand and analyse a problem and find its solution through analysis of data given
3. To fine-tune the quantitative analysis and problem-solving skills

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>08 Hrs.</b> |
| <b>Vocabulary Development:</b> Vocabulary Building Techniques, Root Words, Antonyms & Synonyms, Sentence Completion, Error Detection & Correction, Reading Comprehension   |                |
| <b>UNIT-II</b>   | <b>08 Hrs.</b> |
| <b>Numbers, Proportion &amp; Finance:</b> Number System, Factors & Multiples, The God of Math – Linear Equations, Ratio-Proportion-Variation, Percentages, Profit & Loss, Interest, Averages & Alligations   |                |
| <b>UNIT-III</b>  | <b>07 Hrs.</b> |
| <b>Time &amp; Probability:</b> Time & Work, Time Speed, & Distance, Permutations & Combinations, Probability   |                |
| <b>UNIT-IV</b>   | <b>07 Hrs.</b> |
| <b>Verbal, Analytical, and Visual Reasoning:</b> Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars, Visual Reasoning, Analytical Puzzles, Mathematical, Arrangement & Classification Puzzles   |                |
| <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. George J Summers, "The Great Book of Puzzles &amp; Teasers", Jaico Publishing House, 1989</li> <li>6. Shakuntala Devi , "Puzzles to Puzzle You", Orient Paper Backs, New Delhi, 1976</li> <li>7. R. S. Aggarwal, "A Modern Approach to Logical Reasoning", Sultan Chand and Sons, New Delhi, 2018</li> <li>8. Cambridge Advanced Learner's Dictionary, Cambridge University Press. Kaplan's GRE guide</li> </ol> |                |
| <b>Course Outcomes</b>   |                |

After active participation in this course, the student will have

**CO1:** Enhanced his/her vocabulary and learnt techniques to augment it further

**CO2:** Learned the techniques to augment his/her verbal ability

**CO3:** Understood step-by-analysis of the given problem and learnt to develop a method for solving it

**CO4:** Enhanced and augmented his/her ability to work with quantitative problems

| <b>CO</b>  | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PO12</b> | <b>PSO1</b> | <b>PSO2</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO1</b> |            | 1          |            |            |            |            |            |            | 2          | 3           |             | 1           |             |             |
| <b>CO2</b> |            | 1          |            |            |            |            |            |            | 2          | 3           |             |             |             |             |
| <b>CO3</b> |            | 2          | 2          | 3          |            |            |            |            |            |             |             | 1           |             |             |
| <b>CO4</b> |            | 1          |            | 2          |            |            |            |            |            |             | 2           | 1           |             |             |



|                                   |                                      |                    |
|-----------------------------------|--------------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC601C | <b>Information Theory and Coding</b> | <b>Credits: 03</b> |
| L:T:P - 3 :0: 0                   |                                      | CIEMarks:50        |
| Total Hours/Week: 03              |                                      | SEEMarks:50        |

| UNIT-I  | 10 Hrs. |
|---|---------|
| <p><b>Information theory:</b> Introduction, measure of information, average information content of symbols in long independent sequences, average information content of symbols in long dependent sequences, Markov statistical model for information source, entropy and information rate of Markov source.</p> <p><b>Source Coding:</b> Properties, Shannon's encoding algorithm, Shannon-Fano encoding algorithm, Huffman Coding.</p>   |         |
| UNIT-II   | 10 Hrs. |
| <p><b>Communication channels:</b> Discrete communication channels, entropy functions and equivocation, mutual information, properties of mutual information, rate of information transmission over a discrete channel, capacity of a discrete memory less channel, Shannon's theorem on channel capacity, channel efficiency and redundancy, symmetric/uniform channel, binary symmetric channel, binary erasure channel. Shannon-Hartley law and its implications.</p>   |         |
| UNIT-III  | 10 Hrs. |
| <p><b>Error control coding:</b> Introduction, types of errors, examples of error control coding, methods for controlling errors, types of codes. <b>Linear Block Codes:</b> Matrix description of LBC, encoding circuit for (n, k) linear block codes, syndrome and error correction, syndrome calculation circuit, Hamming weight, Hamming distance and minimum distance of LBC, error detection and correction capability of LBCs, standard array.</p>  |         |
| UNIT-IV   | 10 Hrs. |
| <p><b>Binary Cyclic Codes:</b> Algebraic structure of cyclic codes, encoding using (n, k) bit shift register, syndrome calculation, error detection and correction.</p> <p><b>Convolution codes:</b> Connection pictorial representation, time and transform domain approach, systematic convolution codes, <b>Structural properties of convolution codes:</b> State diagram, code tree, trellis diagram.</p>   |         |
| Reference Books *   |         |
| <ol style="list-style-type: none"> <li>1. P.S. Satyanarayana, 2004, Concepts of information theory and coding (2<sup>nd</sup> edition) Dynaram.</li> <li>2. Bernard Sklar, 2002, Digital communication fundamentals and applications (2<sup>nd</sup> edition) Pearson education.</li> <li>3. K. Sam Shanmugam, 1996, Digital and analog communication systems, John Wiley.</li> <li>4. Simon Haykin, 2003, Digital communication, John Wiley.</li> </ol>  |         |
| Course Outcomes**   |         |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Demonstrate the basic information theory concepts, entropy, need of coding and working of</li> <li>2. different types of source coding techniques.</li> <li>3. Derive channel capacity expression for different types of discrete communication channels and describe entropy functions, equivocation, mutual information of communication channel.</li> <li>4. Design an encoder, decoder, and error correction circuit for linear block code.</li> <li>5. Design an encoder, decoder and error correction circuit for cyclic code and demonstrate encoding of convolutional codes, also verify its structural properties using code tree and trellis diagram.</li> </ol> |         |

\*Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO2</b>      | 3                        | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO3</b>      | 3                        | 3 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| <b>CO4</b>      | 3                        | 3 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

|  |                               |                    |
|--|-------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC602C</b> | <b>Electromagnetic Theory</b> | <b>Credits: 03</b> |
| L:T:P - 2 : 2 : 0                        |                               | CIE Marks: 50      |
| Total Hours/Week: 04                     |                               | SEE Marks: 50      |

|   |                |
|---|----------------|
| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| Coulomb's Law and electric field intensity: Introduction to coulomb's law, field intensity, field due to continuous volume charge distribution, Field of a line charge & field of sheet charge, Electric flux density Gauss law and divergence: Electric flux density, Gauss law, Application of Gauss law for symmetrical charge distribution (point charge, Coaxial cable) and differential volume element, Divergence, Maxwell's first equation, vector operator del and divergence theorem.   |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| Energy and potential: Energy expended in moving a point charge in an electric field, the line integral, definition of potential difference and potential, the potential field of a point charge, potential field of system of charges, potential gradient, Energy density in an Electrostatic Field.<br>Conductors, dielectrics and capacitance: Current and current density, continuity of current, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples (Parallel plate capacitor, Dielectric boundary normal to plates).  |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| Poisson's and Laplace's equations: Poisson's and Laplace's equations. Uniqueness theorem, examples of the solution of Laplace and Poisson's equations.<br>The steady Magnetic Field: Biot-savart's law, Ampere's Circuital Law, curl, Stokes theorem, magnetic flux density, scalar and vector magnetic potentials.   |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| Time varying fields and Maxwell's equations: Faraday's Law, Displacement Current, Maxwell's equation in point and integral form, retarded potentials.<br>Uniform Plane Wave: Wave Propagation In free space and Dielectrics, Poynting's Theorem and wave power, Plane wave in boundaries and in dispersive media: Reflection Uniform Plane Wave At normal incidence, SWR.   |                |
| <b>Reference Books *</b>  |                |
| <ol style="list-style-type: none"> <li>1. William H Hayt Jr, John A Buck, "Engineering Electronics", Tata McGraw-Hill, 7<sup>th</sup> edition, 2006</li> <li>2. John Krauss and Daniel A Fleisch, "Electromagnetics with application", McGraw-Hill, 5<sup>th</sup> edition, 1999</li> <li>3. David K Cheng, "Field and wave Electromagnetics" Pearson Education Asia, 2<sup>nd</sup> edition, -1989, Indian Reprint-2001.</li> </ol>  |                |
| <b>Course Outcomes**</b>  |                |
| <b>After completion of the course student will be able to</b>   |                |
| <ol style="list-style-type: none"> <li>1. Understand the concept of scalar, vectors, Coulomb's law, Electric field intensity, Gauss law and its applications, divergence and analyze the problems based on the mentioned laws</li> <li>2. Understand potential due to charges, potential gradient, continuity equation, boundary conditions and capacitance and Analyze the problems based on the mentioned laws</li> <li>3. Understand Poisson's, Laplace's equation and its application, Uniqueness theorem, Biot-savart's law, ampere's law, Stokes theorem and Curl with respect to magnetic fields and analyze the problems related to the mentioned laws</li> <li>4. Understand about time varying fields, Maxwell's equation, retarded potential, wave propagation in free space, Poynting's theorem, uniform plane waves, Polarization of plane waves, Standing Wave Ratio (SWR) and analyze the problems based on the mentioned laws.</li> </ol> |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| <b>Course Outcomes</b> | <b>Programme Outcomes (POs)</b> |          |          |          |          |          |          |          |          |           |           |           | <b>Program Specific Outcomes (PSOs)</b> |          |          |
|------------------------|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|---|----------|----------|
|                        | <b>1</b>                        | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>1</b>                                | <b>2</b> | <b>3</b> |
| <b>CO1</b>             | 3                               | 3        | 3        | 2        | 2        | 2        | 2        | 1        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO2</b>             | 3                               | 2        | 3        | 2        | 1        | 2        | 2        | 1        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO3</b>             | 3                               | 2        | 3        | 2        | 2        | 2        | 2        | 1        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO4</b>             | 3                               | 3        | 3        | 3        | 3        | 3        | 3        | 1        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |



|                                    |                                     |                    |
|------------------------------------|-------------------------------------|--------------------|
| <b>SUBJECT CODE:<br/>21UEC604L</b> | <b>Computer Networks Laboratory</b> | <b>Credits: 01</b> |
| L:T:P - 0 : 0 : 2                  |                                     | CIE Marks: 50      |
| Total Hours/Week: 02               |                                     | SEE Marks: 50      |

| SL.N<br>o.  | LISTOF EXPERIMENTS  |
|---|---|
| 1.  | Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool |
| 2.  | Study of network components/devices:i)NICii)Hubiii)Switch   |
| 3.  | Connecting computers on Local Area Network(LAN)   |
| 4.  | Study of packet tracer  |
| 5.  | Configuration of different network topologies using packet tracer   |
| 6.  | Configuration of switch and establishing LAN using packet tracer  |
| 7.  | Creation of Virtual LAN(VLAN)using packet tracer  |
| 8.  | Configuration Of Basic Routing Using Packet Tracer  |
| 9.  | Configuration of a network using Routing Information Protocol(RIP)using packet tracer   |
| 10.   | Configuration of a network using Open Shortest path First(OSPF)using packet tracer  |
| 11.   | Configuration of DHCP using packet tracer   |
| 12.   | Configuration of NAT using CISCO packet tracer  |
| <b>Course Outcomes**</b>  |   |
| <b>After completion of the course student will be able to</b>   |   |
| <ol style="list-style-type: none"> <li>1. To Apply the concepts of Data Communication and Networking</li> <li>2. To do Internetworking &amp; devices</li> <li>3. To Develop New Routing techniques</li> <li>4. Practically Know The Functionality of devices using RIP, OSPF, DHCP,and NAT</li> </ol> |   |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 2 | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 1                                | 0 | 3 |
| <b>CO2</b>      | 3                        | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0  | 0  | 0  | 1                                | 0 | 3 |
| <b>CO3</b>      | 3                        | 2 | 3 | 2 | 1 | 1 | 1 | 0 | 1 | 1  | 1  | 0  | 1                                | 0 | 3 |
| <b>CO4</b>      | 3                        | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1  | 1  | 1  | 1                                | 0 | 3 |

|                                    |  |                    |
|------------------------------------|--|--------------------|
| <b>SUBJECT CODE:<br/>21UEC605L</b> | <b>Advanced Communication Laboratory</b> | <b>Credits: 01</b> |
| L:T:P - 0 : 0 : 2                  |  | CIE Marks: 50      |
| Total Hours/Week: 02               |  | SEE Marks: 50      |

| Sl.No.   | LIST OF EXPERIMENTS   |
|--|---|
| 1.   | Verification Of The Sampling Theorem  |
| 2.   | Generation and detection of ASK signal  |
| 3.   | Generation and detection of FSK signal  |
| 4.   | Generation and detection of PSK signal  |
| 5.   | Study of radiation pattern of DIPOLE antenna  |
| 6.   | Study of radiation pattern of HORN antenna  |
| 7.   | Study of radiation pattern of YAGI-UDA antenna  |
| 8.   | Measurement of frequency and wavelength of a microwave source                           |
| 9.   | Study the mode characteristics of Reflex klystron                                       |
| 10.  | Measurement of coupling factor, insertion loss and directivity of a Directional Coupler |
| 11.  | Study of Magic Tee and its characteristics  |
| 12.  | Study of V-I characteristics of Gunn diode and Gunn diode as an oscillator              |
| 13.  | To Study the characteristics of low pass and high pass microstrip filter                |
| 14.  | To Study the characteristics of band pass and band stop microstrip filters              |
| 15.  | To study the characteristics of ring resonator in microstrip                            |
| 16.  | To study and plot the radiation pattern of microstrip patch antenna                     |
| <b>Course Outcomes**</b>   |   |
| <b>After completion of the course student will be able to</b> <ol style="list-style-type: none"> <li>1.Design and test the digital modulation techniques and analyze the waveforms</li> <li>2.Determine The Radiation Pattern Of Different Antennas</li> <li>3.Determine the characteristics and response of microwave devices</li> <li>4.Determine the characteristics of micro strip antennas and devices and compute the parameters associated with it</li> </ol> |   |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 2                        | 2 | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 2  | 1  | 0  | 3                                | 0 | 0 |
| CO2             | 2                        | 2 | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 2  | 1  | 0  | 3                                | 0 | 0 |
| CO3             | 2                        | 2 | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 2  | 1  | 0  | 3                                | 0 | 0 |
| CO4             | 2                        | 2 | 3 | 1 | 2 | 0 | 0 | 1 | 2 | 2  | 1  | 0  | 3                                | 0 | 0 |

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| <b>SUBJECT CODE:</b><br><b>21UEC606E</b> | <b>Biomedical Signal Processing</b> | <b>Credits: 03</b> |
| L:T:P - 3 : 0 : 0                        |                                     | CIE Marks: 50      |
| Total Hours/Week: 03                     |                                     | SEE Marks: 50      |

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| <b>UNIT-I</b> | <b>10 Hrs.</b> |
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**Introduction to Biomedical Signal:** The nature of biomedical signals, objectives of biomedical signal analysis, difficulties encountered in biomedical signal analysis, Computer aided diagnosis.  
**Neurological Signal processing:** Brain and its potentials, Electrophysiological origin of Brain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, Autoregressive (AR) method, Recursive Estimation of AR parameters, Spectral error measure, Adaptive segmentation.

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| <b>UNIT-II</b> | <b>10 Hrs.</b> |
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**Filtering for Removal of Artifacts:** Random noise, structured noise and physiological interference, stationary versus non-stationary processes, typical case study, Time domain filters with application: Synchronized averaging, moving-average filters. Frequency domain filters with examples: removal of high frequency noise by Butterworth low pass filters, removal of low frequency noise by Butterworth high pass filter, removal of periodic artifacts by notch and comb filters. Optimal filtering: Weiner filter.

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| <b>UNIT-III</b> | <b>10 Hrs.</b> |
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**Signal Averaging:** Basics of signal averaging, Signal averaging as a digital filter, A typical average, Software for signal averaging, Limitations of signal averaging.  
 Data Acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of Sleep-wake Transitions, Hypnogram Model Parameters.  
**Cardiological Signal Processing:** ECG Parameters and their estimation

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| <b>UNIT-IV</b> | <b>10 Hrs.</b> |
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**Adaptive Interference/Noise Cancellation:** A review of Wiener filtering problem, Principle Of an adaptive filter, the steepest descent algorithm, Adaptive noise canceller, Cancellation of 60Hz Interference in ECG, Canceling Donor heart Interference in Heart-transplant ECG, Cancellation of Electrocardiographic signals from the electrical activity of chest muscles, Canceling of maternal ECG in Fetal ECG, Cancellation of higher frequency noise in electro- surgery.  
**ECG Data Reduction Techniques:** Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison.

**Reference Books \***

1. Rangaraj M Rangayyan, "Biomedical signal analysis- A case- study approach", Wiley 2009.
2. D. C. Reddy, "Biomedical Signal Processing- Principles and Techniques", Tata McGraw Hill, 2008.
3. Willis J. Tompkins, "Biomedical Digital Signal Processing", PHI, 2006.
4. Akay M, "Biomedical Signal Processing", Academic Press 1994.

**Course Outcomes\*\***



**After completion of the course student will be able to**

1. Analyze the nature of Biomedical signals and related concepts.
2. Apply filters to remove noise from biomedical signals.
3. Apply averaging technique on biomedical signals and extract the features of EEG and ECG signals. Also analyze event detection techniques for EEG and ECG signals.
4. Apply different filters for noise cancellation and signal compression techniques on biomedical signals.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1  | 1  | 2  | 3                                | 0 | 0 |
| CO2             | 3                        | 3 | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0  | 0  | 2  | 3                                | 0 | 0 |
| CO3             | 3                        | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0  | 0  | 2  | 3                                | 0 | 0 |
| CO4             | 3                        | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0  | 0  | 2  | 3                                | 0 | 0 |

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|--|------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC607E</b> | <b>Computer Organization</b> | <b>Credits: 03</b> |
| L:T:P - 3 : 0 : 0                        |                              | CIE Marks: 50      |
| Total Hours/Week: 03                     |                              | SEE Marks: 50      |

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| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| <p><b>Basic Structure of Computers:</b> Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective.</p> <p><b>Machine Instructions and Programs:</b> Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing. Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.</p>   |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| <p><b>Input/Output Organization:</b> Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Interface Circuits, Standard I/O Interfaces–PCI Bus and USB.</p>   |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| <p><b>Memory System:</b> Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size and Cost, Cache Memories–Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage. <b>Arithmetic:</b> Addition And Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers</p>  |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| <p><b>Arithmetic Cont.:</b> Signed, Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.</p> <p><b>Basic Processing Unit:</b> Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control and Microprogrammed Control.</p>  |                |
| <b>Reference Books *</b>  |                |
| <ol style="list-style-type: none"> <li>1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Tata McGraw Hill, 5th Edition, 2002</li> <li>2. David A. Patterson, John L. Hennessy, “Computer Organization and Design – The Hardware /Software Interface ARM Edition”, Elsevier, 4<sup>th</sup> Edition, 2009</li> <li>3. William Stallings, “Computer Organization &amp; Architecture”, PHI, 7th Edition, 2006</li> </ol>  |                |
| <b>Course Outcomes**</b>  |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Have thorough knowledge about structure and performance of a modern digital computer.</li> <li>2. Analyze the different ways of communicating with I/O devices and standard I/O interfaces in a compute including using interrupt.</li> <li>3. Analyze memory hierarchy including main memory, cache memory, virtual memory and secondary memory considering cost/performance. Different Mapping Functions of cache.</li> <li>4. Implement arithmetic operations like multiplication, division and analyze the process of instruction execution of a complete instruction in the processing unit and its control.</li> </ol> |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable



|  |   |                    |
|--|---|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC608E</b> | <b>Digital Image Processing (Department Elective)</b> | <b>Credits: 03</b> |
| <b>L:T:P - 3: 0: 0</b>                   |   | <b>CIEMarks:50</b> |
| <b>Total Hours/Week: 03</b>              |   | <b>SEEMarks:50</b> |

**Course Objectives:**

1. To provide the basic knowledge on image processing concepts.
2. To develop the ability to apprehend and implement various image processing algorithms.
3. To understand various image processing steps and their applications in real time
4. To facilitate the students to comprehend the contextual need pertaining to various image processing applications.

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Introduction- Digital Image, its Representation & point operations: Image Representation and Image Processing Paradigm - Elements of digital image processing, Image model. Sampling and quantization-Relationships between pixels- Connectivity, Distance Measures between pixels, Color image (overview, various color models)-Various image formats bmp, jpeg, tiff, png, gif, etc. Noise in Images Sources, types. Arithmetic operations, Logical operations, Spatial operations Single pixel, neighbour hood, geometric-Contrast Stretching-Intensity slicing-Bit plane slicing Power Law transforms. |                |
| <b>UNIT- II</b>  | <b>10 Hrs.</b> |
| Image Enhancement: Spatial and Frequency domain-Histogram processing-Spatial filtering-Smoothing spatial filters, Sharpening spatial filters; Frequency filtering-Smoothing frequency filters-Sharpening frequency filters, Selective filtering.<br>Image Restoration: Noise models - Degradation models-Methods to estimate the degradation-Image deblurring Restoration in the presence of noise only spatial filtering-Periodic noise reduction by frequency domain filtering-Inverse filtering-Wiener Filtering.   |                |
| <b>UNIT- III</b>   | <b>10 Hrs.</b> |
| Feature Extraction: Region of interest (ROI) selection - Feature extraction: Histogram based features - Intensity features-Color, Shape features-Contour extraction and representation-Homogenous region extraction and representation-Texture descriptors.<br>Image Segmentation: Discontinuity detection-Edge linking and boundary detection. Thresholding-Region oriented segmentation- Histogram based segmentation. Object recognition based on shape descriptors.  |                |
| <b>UNIT- IV</b>  | <b>10 Hrs.</b> |
| Image Coding and Compression: Lossless compression versus lossy compression-Measures of the  |                |

compression efficiency- Huffmann coding, Bit plane coding, Arithmetic coding. Wavelet Transform in image processing: Wavelet Transform in one dimensions, Wavelet transforms in two dimensions. Fast Wavelet Transform , Other Applications of Wavelet in image processing.

**Reference Books \***

Author/s last Name, initial (Year), Book Title (edition), Publisher

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018.
2. William
2. K. Pratt, Digital Image Processing, 4th Edition, John Wiley, 2007.
3. Fundamentals of Digital Image Processing, Jain A.K., PHI, 1997
4. Insight into wavelets - From theory to practice, K. P. Soman and K. I. Ramchandran, PHI ,2005, Second Edition.
5. Rafael C. Gonzalez, “Digital Image processing using MATLAB”, Richard E. Woods and Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.

**Course Outcomes\*\***

**After completion of the course student will be able to**

- 1. Ascertain and describe the basics of image processing concepts through mathematical interpretation and operations.**
- 2. Acquire the knowledge of various image enhancement techniques involved.**
- 3. Demonstrate image restoration process and its respective filters required.**
- 4. Experiment the various image segmentation and feature extraction operations.**
- 5. Design the various image coding and compression procedures and illustrate the wavelet transform in images with its applications.**

**\*Books to be listed as per the format with decreasing level of coverage of syllabus  
Course Articulation Matrix**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    | Program Specific Outcomes (PSOs) |   |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----------------------------------|---|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12                               | 1 | 2 | 3 |
| <b>CO1</b>      | 3                        | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 1  | 0  | 1                                | 3 | 0 | 0 |
| <b>CO2</b>      | 3                        | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 1  | 0  | 1                                | 3 | 0 | 0 |
| <b>CO3</b>      | 3                        | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 1  | 0  | 1                                | 3 | 0 | 0 |
| <b>CO4</b>      | 3                        | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 1  | 0  | 1                                | 3 | 0 | 0 |
| <b>CO5</b>      | 3                        | 3 | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 1  | 0  | 1                                | 3 | 0 | 0 |

## Assignment:

Students are required to develop programs using Matlab.

### List of Programs

1. Write program to read and display digital image using MATLAB or SCILAB
  - a. Become familiar with SCILAB/MATLAB Basic commands
  - b. Read and display image in SCILAB/MATLAB
  - c. Resize given image
  - d. Convert given colour image into gray-scale image
  - e. Convert given colour/gray-scale image into black & white image
  - f. Draw image profile
  - g. Separate colour image in three R G & B planes
  - h. Create colour image using R, G and B three separate planes
  - i. Write given 2-D data in image file
2. To write and execute image processing programs using point processing method
  - a. Obtain Negative image
  - b. Obtain Flip image
  - c. Thresholding
  - d. Contrast stretching
3. To write and execute programs for image arithmetic operations
  - a. Addition of two images
  - b. Subtract one image from other image
  - c. Calculate mean value of image
  - d. Different Brightness by changing mean value

4. To write and execute programs for image logical operations
  - a. AND operation between two images
  - b. OR operation between two images
  - c. Calculate intersection of two images
  - d. Water Marking using EX-OR operation
  - e. NOT operation (Negative image)
5. To write a program for histogram calculation and equalization using
  - a. Standard MATLAB function
  - b. Program without using standard MATLAB functions
6. To write and execute program for geometric transformation of image
  - a. Translation b. Scaling c. Rotation d. Shrinking e. Zooming
7. To understand various image noise models and to write programs for
  - a. image restoration b. Remove Salt and Pepper Noise c. Minimize Gaussian noise d. Median filter and Weiner filter
8. Write a program in MATLAB/SCILAB for edge detection using different edge detection mask
9. To write and execute program for wavelet transform on given image and perform inverse wavelet transform to reconstruct image.

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| <b>SUBJECT CODE:</b><br><b>21UEC609E</b> | <b>Embedded System</b> | <b>Credits: 03</b> |
| L:T:P - 3 : 0 : 0                        |                        | CIE Marks: 50      |
| Total Hours/Week: 03                     |                        | SEE Marks: 50      |

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| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| Introduction to embedded systems, embedded system vs. general computing system, classifications, purpose of embedded system, major application areas including some novel applications. The typical embedded system: Core of embedded system, memory, sensors and actuators, communication interface, Characteristics and quality attributes of embedded systems.   |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, architecture of ARM Cortex M3, various units in the architecture, debugging support, general purpose registers, special registers, exceptions, interrupts, stack operation, reset sequence.   |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| Hardware software co-design and program modeling: fundamental issues in hardware software co-design, computational models in embedded system, hardware software trade-offs. Embedded firmware design and development: design approaches, Mixing assembly and high level language, Programming in embedded C.  |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| Real-time operating system based embedded system: operating system basics, need for RTOS, types of operating system, tasks, process and threads, multiprocessing and multitasking, task scheduling, threads, processes and scheduling : putting altogether, task communication, task synchronization, device drivers.   |                |
| <b>Reference Books *</b>  |                |
| <ol style="list-style-type: none"> <li>1. Shibu K V, "Introduction to embedded systems", Tata McGraw Hill private limited, 2010.</li> <li>2. Joseph Yiu, "The definitive guide to the ARM CORTEX-M3", Newnes, Second edition.</li> <li>3. Rajkamal, "Embedded systems: architecture, programming and design", Tata McGraw Hill private limited, second edition.</li> <li>4. Frank Vahid, Tony Givargis, "Embedded system design: A unified hardware/software introduction", John Wiley and Sons, 2001.</li> </ol>   |                |
| <b>Course Outcomes**</b>  |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. <b>Gain comprehensive knowledge about embedded systems, major application area of embedded systems and system components like memory, sensors and actuators.</b></li> <li>2. <b>Gain comprehensive knowledge about ARM-32 bit Microcontroller, architecture and other internal details.</b></li> <li>3. <b>Develop embedded applications on IDE environment and programming in embedded 'C'.</b></li> <li>4. <b>Explore one opensource RTOS and demonstrate the basic concepts of RTOS.</b></li> </ol> |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable





|                                    |                          |                      |
|------------------------------------|--------------------------|----------------------|
| <b>SUBJECT CODE:<br/>21UEC610E</b> | <b>Wireless Networks</b> | <b>Credits: 03</b>   |
| <b>L:T:P - 3 : 0 : 0</b>           |                          | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 03</b>        |                          | <b>SEE Marks: 50</b> |

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| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Wireless networks: Wireless network architectures, classification of wireless networks, wireless switching technology, wireless communication problems, wireless network reference model, wireless networking issues, wireless networking standards. Wireless Body Area Network(WBAN): Properties, network architecture, network components, design issues, network protocols, WBAN Technologies, WBAN Applications. Wireless Personal Area Network(WPAN): Wireless Personal Area Network, network architecture, Piconet and Scatternet, WPAN components, WPAN technologies and protocols, WPAN Applications.  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| WirelessLocalAreaNetwork(WLAN):Networkcomponents,designrequirements,WLAN, network architecture, WLAN standards, WLAN protocols, IEEE 802.11p, WLAN Applications  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| Wireless Metropolitan Area Network (WMAN): Wireless Metropolitan area networks, WMAN network architecture ,network protocols, broadband wireless networks, WMAN Applications. Ad-hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| MAC Protocols for ad hoc wireless networks: Introduction, issues in designing a MAC protocol for Ad hoc wireless networks, design goals of a MAC protocol for Ad hoc wireless networks, classification of MAC protocols, contention based protocols with reservation mechanisms. Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. Overview of ad hoc routing protocols.   |                |
| <b>Reference Books *</b>   |                |
| 1.Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, “Wireless and Mobile Networks:Concepts and Protocols”, Wiley-India, First Edition, 2010<br>2.C.SivaRamMurthy,B.S.Manoj“AdhocwirelessNetworks”,PearsonEducation,2 <sup>nd</sup> Edition, 2005.<br>3.KavehPahlavan,P.Krishnamurthy,“PrinciplesofWirelessNetworks”,Pearson Education, First Edition, 2002<br>4.Yi-BingLin,ImrichChlamtac,“WirelessandMobileNetworkArchitectures”,John Wiley, First Edition, 2001<br>5.MarlynMallick,“MobileandWirelessDesignEssentials”,Wiley,FirstEdition,2003<br>6.William C. Y. Lee, “Mobile Cellular Telecommunication – Analog and Digital Systems”, McGraw Hill, 2 <sup>nd</sup> Edition, 1995 |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b>  |                |
| <ol style="list-style-type: none"> <li>1. Understand Fundamentals Of Wireless Networks</li> <li>2. Analyzeuniquecharacteristicsandvariousdesignissuesinwirelessnetworks</li> <li>3. Demonstrate basic skills for different types of wireless networks design</li> <li>4. Apply knowledge of various TCP/IP protocols for wireless networking.</li> </ol>   |                |

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable



|  |                          |                    |
|--|--------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC611N</b> | <b>Sensor Technology</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |                          | CIE Marks: 50      |
| Total Hours/Week: 03                     |                          | SEE Marks: 50      |

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| <b>UNIT-I</b> | <b>xx Hrs.</b> |
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**Sensor Fundamentals:** Introduction, Definition, Types, and Sensor Characteristics  
**Principles of Sensing:** Capacitive, Magnetic, Inductive, Resistive, Piezoelectric, Piezoresistance, Pyroelectric, Hall effect.  
**Interfacing Electronic Circuits:** Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, A to D Converters, Bridge Circuits, Data Transmitters, Batteries for low power sensors

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| <b>UNIT-II</b> | <b>xx Hrs.</b> |
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**Overview of Sensor Materials:** Sensor materials and material properties, Surface Processing of materials for development of Sensors.  
**Sensor Technologies:** Micro technology, Micro-Electro-Mechanical Systems Technology, Nanotechnology  
**Sensor Applications:** Displacement Sensing, level & Velocity Sensors, Accelerometers, Tactile Sensors, Pressure Sensors, Temperature Sensors, Comb drive Sensors.

|                 |                |
|-----------------|----------------|
| <b>UNIT-III</b> | <b>xx Hrs.</b> |
|-----------------|----------------|

**Mechanical and Electromechanical sensor:** Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity.  
**Strain gauge:** Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature,  
**Capacitive sensors:** Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect  
**Case Study:** Piezoelectric and Capacitive Pressure Sensors, Cantilever based DNA Sensor, CNT based Pressure Sensor.

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| <b>UNIT-IV</b> | <b>xx Hrs.</b> |
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Interfacing: Communication Basics, parallel, serial and wireless communication, Basic protocol concept, communication protocols, USB interface, Processor interfacing basics, Controller and computer based control implementations. Introduction to wireless sensor network and wireless network protocols

|                          |
|--------------------------|
| <b>Reference Books *</b> |
|--------------------------|

1. Jacob Fraden, "Handbook of Modern Sensors: Physical Design & Applications", AIP Press, Springer.
2. D. Patranabis, "Sensors & Transducers", PHI Publication New Delhi.
3. Frank Vahid, Tony Givargis, "Embedded system Design", John Wiley & Sons, Inc, 2002
4. H.K.P. Neubert, "Instrument transducers", Oxford University press.
5. E.A. Doebelin, "Measurement systems: application & design", Mc Graw Hill

|                          |
|--------------------------|
| <b>Course Outcomes**</b> |
|--------------------------|

- After completion of the course student will be able to**
1. Use concepts for converting a physical parameter into an electrical quantity
  2. Identify appropriate sensor materials and technology while designing sensors
  3. Comprehend working principle of mechanical, strain gauge and capacitive sensors.
  4. Set up sensor data acquisition and communication strategies
  5. Suggest sensor performance improvement methodologies

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 2 |   |   | 2 |   | 2 |   |    |    | 2  | 3                                | 1 |   |
| CO2             | 3                        | 1 | 2 |   |   | 3 |   |   | 2 |    |    | 3  | 3                                | 2 |   |
| CO3             | 3                        | 3 | 3 |   | 2 | 2 |   |   |   | 1  |    | 2  | 3                                | 2 |   |
| CO4             | 3                        | 3 | 1 | 2 | 3 | 3 | 3 | 3 |   | 1  | 2  | 3  | 3                                | 3 |   |

|  |   |                    |
|--|---|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC612N</b>   | <b>Image Processing (Open Elective)</b> | <b>Credits: 03</b> |
| L:T:P - 3:0:0  |   | CIEMarks:50        |
| Total Hours/Week:<br>03  |   | SEEMarks:50        |
| <b>Course Objectives:</b>  |   |                    |
| <ol style="list-style-type: none"> <li>To provide the basic knowledge on image processing concepts.</li> <li>To develop the ability to apprehend and implement various image processing algorithms.</li> <li>To understand various image processing steps and their applications in real time.</li> <li>To facilitate the students to comprehend the contextual need pertaining to various image processing</li> </ol> |   |                    |
| <b>UNIT-I</b>  |   | <b>10 Hrs.</b>     |
| Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; image sensing and acquisition; sampling and quantization; representation of digital images, image interpolation, Basic relationship between pixels; arithmetic and logic operations.   |   |                    |
| <b>UNIT–<br/>II</b>  |   | <b>10 Hrs.</b>     |
| Transformation and spatial filtering: Basics of intensity transformation and functions, Histogram Processing, equalization and histogram matching. Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Restoration: Image Restoration: Image Degradation/Restoration Process, Noise Models.  |   |                    |
| <b>UNIT–<br/>III</b>   |   | <b>10 Hrs.</b>     |
| Restoration in the Presence of Noise Only-Spatial Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Color image processing: fundamentals, color models pseudo colour image processing, colour transformations.   |   |                    |
| <b>UNIT–<br/>IV</b>  |   | <b>10 Hrs.</b>     |
| Image Compression: Fundamentals, Image Compression Models and methods: Huffman coding, Golomb coding, arithmetic coding, LZW coding JPEG, predictive coding. Digital watermarking Applications in satellite, sonar, radar, medical areas and process industries.   |   |                    |
| <b>Reference Books *</b>   |   |                    |
| <ol style="list-style-type: none"> <li>R. C. Gonzalez, R. E. Woods, “Digital Image processing”, Addison Wesley/ Pearson education, New Delhi, India, 3rd edition, 2002.</li> <li>A. K. Jain, “Fundamentals of Digital Image processing”, Prentice Hall of India, New Delhi, 2nd Edition, 1997.</li> <li>Rafael C. Gonzalez, “Digital Image processing using MATLAB”, Richard E. Woods and</li> </ol>                   |   |                    |

Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.

4. S. Jayaraman, S. Esakkirajan, T.Veerakumar, "Digital Image Processing", Tata McGraw- Hill Education.

### Course Outcomes

**After completion of the course student will be able to**

1. Articulate the fundamentals of Digital image processing including the simple image formation and relationship between pixels
2. Application of different types of Image transformation techniques, histogram processing and application of spatial filters.
3. Analyze the significance of image restoration and processing of colour images.
4. Illustrate the image compression like lossy and loss less image compression techniques.

#### Assignment:

Students are required to develop programs using Matlab.

List of programs:

1. Image Printing Program Based on Half toning.
2. Reducing the Number of Intensity Levels in an Image.
3. Zooming and Shrinking Images by Pixel Replication.
4. Zooming and Shrinking Images by Bilinear Interpolation.
5. Arithmetic Operations.
6. Image Enhancement Using Intensity Transformations.
7. Histogram Equalization.
8. Spatial Filtering.
9. Enhancement Using the Laplacian.

#### Course Articulation Matrix

| Course Outcomes | CO- PO, PSO Mapping<br>(3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak |   |   |   |   |   |   |   |   |   |   |      |   |   |   |
|-----------------|--|---|---|---|---|---|---|---|---|---|---|------|---|---|---|
|                 | POs  |   |   |   |   |   |   |   |   |   |   | PSOs |   |   |   |
|                 | a  | b | c | d | e | f | g | h | i | j | k | l    | m | n | o |
| 1.              | 2  |   |   |   |   | 3 |   |   |   |   |   |      | 3 | 3 | 3 |
| 2.              |  |   | 3 |   | 2 | 3 | 2 |   |   |   |   | 2    |   | 2 |   |
| 3.              |  |   | 3 |   |   |   |   |   | 2 |   |   | 3    | 1 |   | 3 |
| 4.              |  |   | 3 |   | 3 |   |   |   | 3 |   |   | 3    | 3 | 3 | 3 |

|  |   |                    |
|--|---|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC613N</b> | <b>Modeling and Simulation of Engineering Systems</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                            |   | CIE Marks: 50      |
| Total Hours/Week: 03                     |   | SEE Marks: 50      |

|               |                |
|---------------|----------------|
| <b>UNIT-I</b> | <b>xx Hrs.</b> |
|---------------|----------------|

**Introduction to Systems:** Introduction, types, properties of systems, LTI Systems, Stability of systems. Non linear systems  
**Mathematical Modeling:** Introduction, types of modeling, Abstraction, Linearity and superposition, balance and conservation laws and the system, boundary approach. Basic system elements in mechanical, electrical, fluid, magnetic and thermal systems

|                |                |
|----------------|----------------|
| <b>UNIT-II</b> | <b>xx Hrs.</b> |
|----------------|----------------|

**Mathematical Modeling of Basic Engineering Systems:** Introduction, Differential equations of basic engineering systems, Transfer functions, Block diagram algebra, Signal flow graphs.  
**Lumped Parameter Models:** Mechanical systems (automobile suspension system, accelerometer), translational, rotational (simple rotational system). hydraulic systems (two tank hydraulic system), thermal systems (simple thermal system). Electrical Systems (capacitor microphone).

|                 |                |
|-----------------|----------------|
| <b>UNIT-III</b> | <b>xx Hrs.</b> |
|-----------------|----------------|

**Analysis of Systems:** Introduction, time domain analysis of first order and second order systems, Frequency response of Linear Time invariant systems: Bode plots, phase margin and gain margin, stability analysis: Routh Hurvitz criteria. Introduction to State space representation of systems

|                |                |
|----------------|----------------|
| <b>UNIT-IV</b> | <b>xx Hrs.</b> |
|----------------|----------------|

**Modeling and Simulation tools:** Introduction, familiarization with modeling and simulation software, Simulation and analysis of mathematical models developed. Introduction to non-linear systems and linearization. Curve fitting in system modeling.

**Reference Books \***

1. Mukherjee A. and Karmakar R. - „Modeling and Simulation of Engineering Systems through Bond graphs - Narosa – 2000
2. I J Nagrath, M Gopal – Control Systems Engineering, New Age International Publishers, Fifth Edition, 2007
3. O. Beucher and M. Weeks - Introduction to MATLAB and Simulink a project based Approach, Infinity Science Press LLC, 2006
4. Chi Tsong Chen – Linear System Theory and Design, Oxford University Press, 1999
5. Ken Dutton, Steve Thompson, Bill Barraclough – The Art of Control Engineering, Addison – Wesley, 1997
6. J N Kapur – Mathematical modeling, New Age International (P) Ltd. New Delhi
7. S. C. Chapra, R. P. Canale – Numerical methods for Engineers, 4<sup>th</sup> Ed., TMH, New Delhi
8. Woods Robert L. and Kent L.- „Modeling and Simulation of Dynamic Systems“- Prentice Hall – 1997
9. Frederick C. - „Modeling and Analysis of Dynamic Systems“- Wiley - 2001 - 3<sup>rd</sup> Edition

**Course Outcomes\*\***

**After completion of the course student will be able to**

1. Build a reduced order model of any engineering system and obtain its mathematical model
2. Visualize various factors to be considered in any engineering system design
3. Simulate the developed model Use software tools (e.g. SCILAB/XCOS) for modeling, simulation, and analysis
4. Analyze the system using simulation results



\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 2 | 0 |
| CO2             | 3                        | 3 | 3 | 0 | 0 | 1 | 2 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO3             | 3                        | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO4             | 3                        | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |



|            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <b>CO1</b> | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 3 | 1 | 0 |
| <b>CO2</b> | 3 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 3 | 2 | 0 |
| <b>CO3</b> | 3 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 3 | 2 | 0 |
| <b>CO4</b> | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 0 | 2 | 2 | 3 | 3 | 3 | 0 |

BVVS  
Basaveshwar Engineering College, Bagalkote  
**Department of Electronics and Communication Engineering**

**Semester End Examination (SEE) Scheme of Evaluation**

**Semester: VI    Course: Mini-Project    Code: 21UEC613P    Credits:02    Hours/Week:--**

**Mini-Project is evaluated as per the guidelines of BEC Examination Reforms Policy. It is evaluated for 50 marks by a committee comprising of 1. Mini-Project Coordinator, 2. HoD/Nominee and 3. External Examiner. The details of evaluation are as follows.**

| <b>Evaluation Criteria</b>   | <b>Very poor (2)</b>                                  | <b>Poor (4)</b>  | <b>Average (6)</b>   | <b>Good (8)</b>  | <b>Very good (10)</b>  | <b>Total marks</b> | <b>Evaluation Committees</b>                         |
|--|---|--|--|--|--|--------------------|--|
| 1. Generate information through appropriate tests to improve or revise design-GA                 | Not able to identify suitable tests to be done        | Able to identify but not able to follow testing procedures | Able to follow testing procedures but not able to collect information    | Able to collect information but not able to apply it for improvement | Able to apply information for the improvement                        | 50                 | Coordinator + HoD/<br>Nominee +<br>External Examiner |
| 2. Use appropriate procedures, tools and techniques to conduct experiments and collect data - GA | Not able to identify tools, techniques and procedures | Able to identify but not able to conduct experiments       | Able to conduct experiments but not able to follow procedure             | Able to follow procedure but not able to collect data                | Able to collect data as per the standards                            |                    |  |
| 3. Analyze data for trends and correlations  | Not able to understand data                           | Able to understand but not able to analyze data            | Able to analyze data but not able to correlate them                      | Able to correlate but not able to identify errors and limitations    | Able to identify errors and limitations                              |                    |  |
| 4. Deliver effective oral presentations to technical and non-technical                           | Could not deliver effective presentations.            | Could not deliver presentation, but presentation was       | Able to deliver fair presentation but notable to answer to the audiences | Deliver effective presentations but able to answer partially to      | Deliver effective presentation and able to answer all queries of the |                    |  |

|   |  |   |  |   |   |
|---|--|---|--|---|---|
| audiences-IA  |  | prepared and attempted.                               |  | the audience queries’.  | audience.   |
| 5. Present results as a team, with Smooth Integration Of Contributions from all Individual efforts – GA+ IA | No Contribution from an individual to a team | Contributions from an individual to a team is minimal | Contributions from an individual to a team is moderate | A contribution From An individual to a team is good but not Well groomed in team. | Contribution from an individual to a team is good and results in an Integrated Team presentation. |

**GA**–Group Assessment

**IA** –Individual Assessment

**Syllabus for  
B.E. VII & VIII – Semester  
(For students admitted to I year in 2021-22)**

|                                   |                                |                    |
|-----------------------------------|--------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC701C | <b>Microwaves and Antennas</b> | <b>Credits: 03</b> |
| L:T:P - 3 : 0 : 0                 |                                | CIEMarks:50        |
| Total Hours/Week: 03              |                                | SEEMarks:50        |

| UNIT-I   | 10 Hrs. |
|--|---------|
| <p><b>Introduction to microwaves:</b> Microwave frequencies, IEEE microwave frequency bands.</p> <p><b>Microwave transmission lines and rectangular waveguides:</b> Introduction, transmission line equations, characteristic and input impedances, reflection and transmission coefficients, standing wave and SWR. Introduction to rectangular waveguides, TE and TM modes in rectangular waveguides.</p> <p><b>Microwave vacuum tube device:</b> Introduction, reflex klystron oscillator (mechanism of oscillation, mode of oscillation, power output and efficiency, mode curve), two cavity klystron amplifier (mechanism of operation).</p> |         |
| UNIT-II  | 10 Hrs. |
| <p><b>Microwave network theory and passive devices:</b> Introduction, S-matrix representation of multi-port network, properties of S-matrix, matched terminations, rectangular to circular waveguide transition, attenuators, precision phase shifter, waveguide tees, E-plane tee, H-plane tee, magic tee, applications of magic tee, faraday rotation isolator, four-port circulator, 2-hole directional coupler.</p> <p><b>Microwave application:</b> Microwave radar systems (radar equation, pulsed radar, CW doppler radar, FMCW radar).</p>   |         |
| UNIT-III   | 10 Hrs. |
| <p><b>Fundamental Parameters of Antennas:</b> Introduction, radiation pattern, radiation power density, radiation intensity, beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, polarization, effective height, input impedance, antenna radiation efficiency, maximum directivity and maximum effective area, Friis transmission equation.</p> <p><b>Antenna arrays:</b> Array of two point sources, broad side array, end fire array, n-isotropic array, pattern multiplication. binomial and Chebyshev arrays, phased array.</p>  |         |
| UNIT-IV  | 10 Hrs. |
| <p><b>Antenna Aperture:</b> aperture concept, types of aperture, maximum effective aperture of short dipole and half wave dipole.</p> <p><b>Antenna practice:</b> Yagi-Uda antenna, turnstile antenna, log periodic antenna, helical antenna, rhombic antenna, horn antenna, parabolic reflector antennas, micro strip antenna and their feed systems.</p>   |         |
| Reference Books *  |         |
| <ol style="list-style-type: none"> <li>1. AnnapurnaDas,SisirK.Das,“MicrowaveEngineering”,TMH,2<sup>nd</sup>Ed,NewDelhi,2009.</li> <li>2. SamuelY.Liao,“MicrowaveDevicesandCircuits”,PearsonEducation,3<sup>rd</sup>Ed,NewDelhi, 2003.</li> <li>3. JohnD.Krauss,RonaldJ.Marhefka,AhmadSKhan,“AntennasandWave Propagation”, McGraw-Hill, 5<sup>th</sup>Ed, New Delhi, 2017.</li> </ol>   |         |

4. Constantine A. Balanis, "Antenna Theory: Analysis and Design", John Wiley, 4<sup>th</sup> Ed, New Delhi, 2016.
5. K. D. Prasad, "Antenna & Wave Propagation", Satyaprakshan, 5<sup>th</sup> Ed, New Delhi 2009.
6. Merrill I. Skolnik, "Introduction to Radar Systems", TMH, 3<sup>rd</sup> Ed, New Delhi, 2001.
7. P. E. Collins, "Antennas and Radio Propagation", McGraw-Hill, New Delhi, 1985
8. Edward C. Jordan, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI New Delhi, 1993.

**Course Outcomes\*\***

After completion of the course student will be able to

1. Acquire the knowledge of transmission line theory, rectangular waveguides and describe microwave vacuum tube device.
2. Analyze microwave passive devices with scattering parameters, and apply microwave application in radar systems.
3. Compute basic antenna parameters using radiation patterns, analyze and design antenna arrays.
4. Analyze The Importance Of Antenna Aperture, explain the working principle of different antennas and their usage in real time field.

\*Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO2             | 3                        | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO3             | 3                        | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO4             | 3                        | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |



|  |                                  |                    |
|--|----------------------------------|--------------------|
| <b>SUBJECT CODE-<br/>21UEC702E</b>                             | <b>Multimedia Communications</b> | <b>Credits: 03</b> |
| L:T:P - N <sub>L</sub> : 3 N <sub>T</sub> : 0 N <sub>P</sub> 0 |                                  | CIE Marks: 50      |
| Total Hours/Week: 03   |                                  | SEE Marks: 50      |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| Introduction, Multimedia information representation, Multimedia networks, Multimedia applications. Introduction, Digitization principles, Text, Images, Audio, Video.  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| Text and Image Compression: Introduction, Compression principles, Text compression, image compression  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| Audio and Video Compression: Introduction, Audio compression, Video compression,   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| Multimedia Network Communications: Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-demand, Multimedia over Wireless Networks.  |                |
| <b>Reference Books *</b>   |                |
| Text Books:<br>1. Multimedia Communications- Fred Halsall, Pearson Education, 2001, ISBN -9788131709948.<br>2. Fundamentals of Multimedia- Ze-Nian LI, Marks. Drew Pearson Education,<br>3. Multimedia Communication Systems- K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Pearson Education, 2004. ISBN -9788120321458.   |                |
| <b>Course Outcomes**</b>   |                |
| <b>After completion of the course student will be able to</b>  |                |
| <ol style="list-style-type: none"> <li><b>1. Identify the latest technological trends in multimedia communication to develop multimedia applications</b></li> <li><b>2. Design and develop digital forms of text and image information of multimedia application.</b></li> <li><b>3. Design and develop digital forms of audio and video information of multimedia application.</b></li> <li><b>4. Identify the QoS parameters of deferent networks of multimedia</b></li> </ol> |                |

### POs satisfied by the course:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of solution:** Design solutions of complex engineering problems and design system components of processes that meet the specified needs with appropriate consideration for public health and safety and cultural, societal and environmental consideration
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. , safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PSOs satisfied by the course:**

1. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
2. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
3. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

| Course Outcomes   | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|---|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|   | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1: Identify the latest technological trends in multimedia communication to develop multimedia applications</b> | 0                        | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1  | 1  |    | 1                                |   | 1 |
| <b>CO2: Design and develop digital forms of text and image information of multimedia application.</b>               | 0                        | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1  | 1  |    | 1                                |   | 1 |
| <b>CO3: Design and develop digital forms of audio and video information of multimedia application.</b>              | 1                        | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1  | 1  | 1  | 1                                | 1 | 1 |
| <b>CO4: Identify the QoS parameters of deferent networks of multimedia</b>  | 1                        | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1  | 1  |    | 1                                |   | 1 |

|                                   |                         |                    |
|-----------------------------------|-------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC703E | <b>Machine Learning</b> | <b>Credits: 03</b> |
| L:T:P –3-0-0                      |                         | CIEMarks:50        |
| Total Hours/Week: 03              |                         | SEEMarks:50        |

|  |                |
|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <p>Introduction: What is Machine Learning? Python: Introduction, Data Types, Conditional statements, loops, functions, scikit-learn.</p> <p>Essential Libraries and Tools: Jupyter Notebook, Numpy, Pandas, Scipy, matplotlib, A First Application: Classifying Iris Species.</p>  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p>Supervised Learning: Classification and Regression, Generalization, Overfitting, and Underfitting, Supervised Machine Learning Algorithms: Some Sample Datasets, k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Neural Networks (Deep Learning).</p>  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p>Unsupervised Learning and Preprocessing: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Preprocessing and Scaling, Dimensionality Reduction, Feature Extraction, and Manifold Learning, Clustering: k-Means Clustering, Agglomerative Clustering</p>  |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p>DimModel Evaluation and Improvement: Cross-Validation, Evaluation Metrics and Scoring.<br/>Working with Text Data: Types of Data Represented as Strings, Example Application: Sentiment Analysis of Movie Reviews, Representing Text Data as a Bag of Words: Applying Bag-of-Words to a Toy Dataset, Bag-of-Words for Movie Reviews, Stopwords.</p>   |                |
| <b>Reference Books *</b>   |                |
| <p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Andreas C. Müller &amp; Sarah Guido, “Introduction to Machine Learning with Python”, Oreilly Publication, 1<sup>st</sup> Edition, 2016</li> <li>2. Core Python Programming by Dr. R.NageswawaRao, Dreamtech press, 2<sup>nd</sup> Edition 2018.</li> <li>3. Gourishankar S. Veena A, “Introduction to Python Programming”, CSC Press, 1<sup>st</sup> edition,2019</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Tom Mitchell,” Machine Learning”, McGraw- Hill, 2<sup>nd</sup> Edition, 2013.</li> <li>2. EthemAlpaydin,” Introduction to Machine Learning”, MIT press, Cambridge, Massachusetts, London, 2<sup>nd</sup> Edition, 2010</li> <li>3. Edition, 2010</li> <li>4. MiroslavKubat,” An Introduction to Machine Learning”, Springer, 2<sup>nd</sup> Edition, 2017</li> <li>5. Christopher Bishop, “Pattern Recognition and Machine Learning”,Springer,2006</li> <li>6. Kevin Murphy, “Machine Learning -aProbabilisticPerspective”,MITPress,2012.</li> <li>7. Joachims, “Learning to Classify Text using Support Vector Machine s”,Kluwer,2002</li> </ol> |                |

8. Ian Good fellow and YoshuaBengio and Aaron Courville,“DeepLearning”,AnMIT Press book.

**E-Resources:**

1. Introduction to Machine Learning(IIT Madras)
2. <https://nptel.ac.in/courses/106106139/>  
Introduction to Machine Learning(IIT Kharagpur)<https://nptel.ac.in/courses/106105152/>

**Course Outcomes\*\***

After completion of the course student will be able to

1. Explain Various Machine Learning Algorithms.
2. Apply machine learning algorithm to solve problems of moderate complexity.
3. Analyze performance of algorithms by varying some parameters
4. To Formulate Machine Learning Model For The Simple Problem

\*Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             |                          | 2 | 2 | 2 |   |   |   |   |   |    |    |    | 1                                |   | 1 |
| CO2             | 1                        | 3 | 3 | 2 | 3 |   |   |   |   |    |    |    | 2                                |   | 2 |
| CO3             | 1                        | 3 | 3 | 3 | 3 |   |   |   |   |    |    |    | 3                                |   | 3 |
| CO4             | 1                        | 3 | 3 | 3 | 3 |   |   |   |   |    |    |    | 3                                |   | 3 |

|                                   |   |                      |
|-----------------------------------|---|----------------------|
| <b>SUBJECT CODE:</b><br>21UEC704E | <b>Micro Electro Mechanical Systems</b> | <b>Credits: 03</b>   |
| <b>L:T:P – 3-0-0</b>              |   | <b>CIE Marks: 50</b> |
| <b>Total Hours/Week: 03</b>       |   | <b>SEE Marks: 50</b> |

| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
|--|----------------|
| <p>Introduction to MEMS Technology: Basic definitions, history and evolution of MEMS. Feynman's vision, microelectronics and MEMS, microsensors, microactuators and microsystems, Types of MEMS, Applications of MEMS in various disciplines. Commercial MEMS products.</p> <p>Multiphysics-Multiengineering aspects of MEMS: Introduction to design, modeling and simulation, optimization, fabrication, reliability and packaging of MEMS.</p> <p>Scaling issues in microsystems, examples and numerical problems based on scaling laws.</p>   |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p>Design and Working Principles of MEMS: Transduction principles in microdomain- Biomedical sensor &amp; biosensor and DNA sensor, chemical sensor, optical sensor, pressure sensor, thermal sensor. Actuation using thermal force, shape-memory alloy, piezoelectric and electrostatic forces. Mechanical sensors and actuators – beams and cantilevers, accelerometers. Electrostatic sensors and actuators – parallel plate capacitors, comb drive sensor and actuator. Optical MEMS – DLP mirror; construction and working.</p>   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p>Modeling and Simulation of MEMS: Basic modeling elements in mechanical systems, electrical systems, microfluidic systems, thermal systems, magnetic domain and electrostatic systems. Measurement tools in microsystems: AFM, SEM and optical interferometry. Characterization methods. Simulation of MEMS: Need for simulation, FEM, MEMS design and realization tools – ANSYS/Multiphysics, CoventorWare, COMSOL. AFM as a measurement tool in microsystems. Case Studies: Microcantilever based sensor, electrothermal actuator, electrostatic actuator.</p>   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p>Microfabrication/Micromachining: Overview of micro fabrication, silicon wafer extraction and cleaning, structural and sacrificial materials in microfabrication, lithography, deposition, doping, etching, Introduction to MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.</p>   |                |
| <b>Reference Books *</b>   |                |
| <ol style="list-style-type: none"> <li>1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan, K. N. Bhat, V. K. Atre, "Micro and smart systems", Wiley, India, 2010.</li> <li>2. N. P. Mahalik, "MEMS", Tata McGraw-Hill, 2007.</li> <li>3. Tai, Ran Hsu, "MEMS and microsystems: design and manufacture", TMH, 2002.</li> <li>4. James J. Allen, "Micro Electro Mechanical System design", CRC Press, Taylor &amp; Francis Group, 2005.</li> <li>5. Chang Liu, "Foundations of MEMS", Pearson education international, 2007.</li> <li>Stephen D. Senturia, "Microsystem design", Springer International edition, 2001.</li> </ol> |                |

## Course Outcomes\*\*

After completion of the course student will be able to

1. Comprehend the fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.
2. Design and understand the working principle of various microsensing and actuating devices.
3. Mathematically model and simulate the various types of micro-systems
4. Comprehend the various steps involved in microfabrication and micromachining of micro devices, structures and systems.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0  | 2  | 0  | 3                                | 3 | 0 |
| CO2             | 3                        | 3 | 3 | 3 | 0 | 0 | 2 | 0 | 0 | 0  | 3  | 0  | 3                                | 3 | 0 |
| CO3             | 3                        | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0  | 3  | 0  | 3                                | 3 | 1 |
| CO4             | 3                        | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0  | 3  | 0  | 3                                | 3 | 0 |

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|-----------------------------------|---------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC718E | <b>VLSI Testing</b> | <b>Credits: 03</b> |
| L:T:P – 3:0:0                     |                     | CIE Marks: 50      |
| Total Hours/Week: 40hrs           |                     | SEE Marks: 50      |

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| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <p><b>Fault Modelling:</b> Importance of Testing, Testing during the VLSI Lifecycle, Challenges in the VLSI Testing: Test Generation, Fault Models, Levels of Abstraction in VLSI Testing, Historical Review of VLSI Test Technology, Fault and Defect modeling: Functional Faults, Structural Faults, Structural Gate Level Faults: Recognizing Faults, Stuck-Open Faults, Stuck-at-0 Faults, Stuck at-1 Faults, Fault Collapsing.</p> <p><b>Fault Simulation and Test Generation:</b> Fault Simulation: Serial, Parallel, Deductive, Concurrent, Combinational Test Generations, ATPG for Combinational Circuits, D-Algorithm, Testability Analysis, SCOAP measures for Combinational Circuits</p> |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <p><b>Design for Testability:</b> Introduction. Testability Analysis, Design for Testability Basics: Ad Hoc Approach, Structured Approach, Scan Cell Designs, Scan Design Rules, Scan Architectures, Scan Design Flow, Special Purpose Scan Designs, RTL Design for Testability.</p>   |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <p><b>Built-in Self-Test:</b> BIST Design Rules, Test Pattern Generation, Exhaustive Testing, Pseudo-Random Testing, Pseudo-Exhaustive Testing, Delay Fault Testing, Output Response Analysis, Logic BIST Architectures, BIST Architectures for Circuits with and without Scan Chains.</p> <p><b>Boundary scan and Core based Testing :</b> Digital Boundary Scan (IEEE Std. 1149.1): Test Architecture and Operations, On-Chip Test Support with Boundary Scan, Board and System-Level Boundary-Scan Control Architectures.</p>   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <p><b>Test Compression and Compaction:</b> Test Stimulus Compression: Code-Based Schemes, Linear-Decompression-Based Schemes, Test <b>Response</b> Compaction.</p> <p><b>Fault Diagnosis:</b> Dictionary based and Adaptive fault diagnosis.</p>   |                |
| <b>Reference Books *</b>   |                |
| <p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Z. Navabi, “Digital System Test and Testable Design”, Springer, 2011.</li> <li>2. Laung-Terng Wang, Cheng-Wen Wu, and Xiaoqing Wen, “VLSI Test Principles and Architectures”, The Morgan Kaufmann, 2013</li> </ol>  |                |
| <b>Course Outcomes**</b>   |                |



**After completion of the course student will be able to**

1. Model different fault models. Simulate faults and generate test patterns for combinational circuits.
2. Analysis and design for testability.
3. Recognize the BIST techniques for improving testability and understand boundary scanbased test architectures.
4. Analyse and apply the test vector compression techniques for memory reduction and fault Diagnosis.

**\* Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |
| CO2             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |
| CO3             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |
| CO4             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |

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| <b>SUBJECT CODE:</b><br>21UEC706E | <b>Advanced Tools for VLSI Design</b> | <b>Credits: 03</b> |
| L:T:P – 3:0:0                     |                                       | CIE Marks: 50      |
| Total Hours/Week: 40hrs           |                                       | SEE Marks: 50      |

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|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <b>Data Structures and Basic Algorithms:</b> Basic Terminology, Complexity Issues and NP-hardness Basic Algorithms, Basic Data Structures, Graph Algorithms for Physical design  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| <b>Partitioning:</b> Problem Formulation, Classification of Partitioning Algorithms, Group Migration Algorithms, Simulated Annealing and Evolution, Other Partitioning Algorithms<br><b>Floor planning and Pin Assignment:</b> Floor planning, Chip planning, Pin Assignment, Integrated Approach  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <b>Placement:</b> Problem Formulation, Classification of Placement Algorithms, Simulation Based Placement Algorithms, Partitioning Based Placement Algorithms, Other Placement Algorithms, Performance Driven Placement, Recent Trends.<br><b>Global Routing:</b> Problem Formulation, Classification of Global Routing Algorithms, Maze Routing Algorithms, Line-Probe Algorithms, Shortest Path Based Algorithms   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <b>Global Routing(Continued.):</b> Steiner Tree based Algorithms, Integer Programming Based Approach, Three-Layer Channel Routing Algorithms<br><b>Clock and Power Routing:</b> Clock Routing, Power and Ground Routing  |                |
| <b>Reference Books *</b>   |                |
| <b>Textbooks:</b>  |                |
| <ol style="list-style-type: none"> <li>1. Naveed A. Sherwani, “Algorithms For VlsiPhysical Design Automation”, Kluwer Academic Publishers</li> <li>2. Andrew B. Kahng, Jens Lienig, Igor L. Markov, JinHu, “VLSI Physical Design: From Graph Partitioning to Timing Closure”, Springer, 2011.</li> <li>3. H. Yosuff and S.M. Sait, “VLSI Physical Design Automation – Theory and Practice”, Cambridge India, 2010.</li> <li>4. Sung Kyu Lim, “Practical Problems in VLSI Physical Design Automation”, Springer India, 2011.</li> </ol> |                |
| <b>Reference Books:</b>  |                |
| <ol style="list-style-type: none"> <li>1. S. Sridhar, “Design and Analysis of Algorithms”, Paperback – OUP, 2014.</li> <li>2. John Okyere Attia, “PSPICE and MATLAB for Electronics: An Integrated Approach”, CRC Press, 2010.</li> <li>3. Ganesh M. Magar, Swati R. Maurya Rajesh K. Maurya, “Graph Theory &amp; Applications”, Technical Publications, 2016.</li> </ol>  |                |

Brian Christian and Tom Griffiths, “Algorithms to Live By: The Computer Science of Human Decisions”, William Collins, 2017.

**Course Outcomes\*\***

**After completion of the course student will be able to**

1. Formulate the graphs for the given problems, Calculate and analyse the computational complexity of physical design algorithms Partition a given design.
2. Express and change the floorplans in an abstract manner and use computer algorithms to make large and optimized floorplans
3. Make optimized placements on the silicon chip and perform complex routing using algorithms and computer codes.
4. Design clock trees to distribute the clock signals on the chip while satisfying various constraints like clock skew and wire length.

**\* Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |
| CO2             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |
| CO3             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |
| CO4             | 1                        | 1 | 1 |   | 3 |   |   |   |   |    |    |    | 3                                |   |   |

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|-----------------------------------|---------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC707E | <b>Speech Signal Processing</b> | <b>Credits: 03</b> |
| L:T:P –3-0-0                      |                                 | CIEMarks:50        |
| Total Hours/Week: 03              |                                 | SEEMarks:50        |

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| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| <p>Digital representation of speech signal. Waveform representation and parametric representation. Sampling rate conversion.</p> <p>Introduction, the process of speech production and classification and basics of phonetics, phonetic description of phonemes, the acoustic theory of speech production, digital models for speech – vocal tract, radiation, excitation the complete model.</p>   |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| <p>Introduction, time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, voiced/unvoiced/silence detection. Pitch period estimation (Rabiner and Gold method), short time autocorrelation function, short time average magnitude difference function, u/v/speech/silence detection.</p>  |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| <p>Introduction, definitions and properties of short time Fourier transform (STFT), Fourier transform interpretation of STFT, linear filtering interpretation of STFT, sampling of STFT, speech analysis and synthesis systems (Vocoders), phase vocoder, channel vocoder.</p>  |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| <p>Introduction, homomorphic transformation, frequency domain representation of homomorphic systems, inverse cepstrum transformation, the complex cepstrum of speech, cepstral vocoder, processing applications of cepstral analysis.</p>   |                |
| <b>Reference Books *</b>  |                |
| <p><b>Textbook:</b></p> <ol style="list-style-type: none"> <li>1. L.R.Rabiner and R.W.Schafer, "Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.</li> </ol> <p><b>Reference Book:</b></p> <ol style="list-style-type: none"> <li>1. D.O'Shaughnessy, "Speech Communications: Human and Machine," Universities Press, 2001.</li> <li>2. B.Gold and N.Morgan, "Speech and Audio Signal Processing: processing and perception of speech and music" Pearson Education, 2003.</li> </ol> |                |
| <b>Course Outcomes**</b>  |                |
| <p><b>After completion of the course student will be able to</b></p> <ol style="list-style-type: none"> <li>1. Explain the speech production and perception mechanism</li> <li>2. Characterize and analyze speech signals in Time domain</li> <li>3. Characterize and analyze speech signals in Frequency domain</li> <li>4. Analyze speech signal using homomorphic transformation and LPC</li> </ol>  |                |

**\*Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| <b>Course Outcome</b> | <b>Programme Outcomes (POs)</b> |          |          |          |          |          |          |          |          |           |           |           | <b>Program Specific Outcomes (PSOs)</b> |          |          |
|-----------------------|---------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|---|----------|----------|
|                       | <b>1</b>                        | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> | <b>11</b> | <b>12</b> | <b>1</b>                                | <b>2</b> | <b>3</b> |
| <b>CO1</b>            | 3                               | 2        | 1        | 0        | 1        | 1        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO2</b>            | 3                               | 3        | 2        | 0        | 1        | 1        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO3</b>            | 3                               | 2        | 1        | 0        | 1        | 1        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |
| <b>CO4</b>            | 3                               | 3        | 1        | 0        | 1        | 1        | 0        | 0        | 0        | 0         | 0         | 0         | 3                                       | 0        | 0        |

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| <b>SUBJECT CODE:</b><br><b>21UEC708E</b> | <b>Course Title: Internet of Things<br/>(Hardware Orientation)</b> | <b>Credits: 03</b> |
| L:T:P:-3:0:0                             |  | CIE Marks: 50      |
| Hours/Week: 03                           |  | SEE Marks: 50      |

**Course Objectives:**

1. To understand the Fundamentals of IoT
2. To explore IoT Applications
3. To examine IoT and M2M Communication
4. To understand IoT Server and Cloud Infrastructure

|  |               |
|--|---------------|
| <b>UNIT-I</b>  | <b>10 Hrs</b> |
| <b>Introduction to Internet of Things (IoT):</b> Definition and characteristics of IoT, Physical Design, Logical Design of IoT, IoT Enabling Technologies, IoT levels and deployments templates. Applications of IoT for: Cities, Environment, Energy system, Logistics, Agriculture, Industry and Health.                               |               |
| <b>UNIT-II</b>   | <b>10 Hrs</b> |
| <b>IoT and M2M:</b> M2M, Difference and Similarities between IoT and M2M, Software Defined Network (SDN) and Network Function Virtualization (NFV) for IoT, Simple Network Management Protocol (SNMP), IoT Platforms Design Methodology.   |               |
| <b>UNIT-III</b>  | <b>10 Hrs</b> |
| <b>IoT Physical Devices and Endpoints:</b> Basic building blocks of an IoT Device, Other IoT Devices. Exemplary Devices: Raspberry Pi, Raspberry Pi interface, Arduino board, Other devices, Case studies Illustrating IoT Design: Smart Lighting, Smart Parking, Weather Monitoring System, Air Pollution Monitoring, Smart Irrigation. |               |
| <b>UNIT-IV</b>   | <b>10 Hrs</b> |
| <b>IoT Physical Servers and Cloud Offerings:</b> Introduction to Cloud Storage Models and Communication APIs, Web Application Messaging Protocol, Django Architecture, Designing RESTful Web API, SkyNet IoT Messaging Platform  |               |
| <b>Data Acquiring, Organizing, Processing and Analytics:</b> Introduction, Data Acquiring and storage, Organizing the data, Data Analytics Architecture and Stack.   |               |
| <b>Reference Books</b>   |               |
| <b>Text Books:</b>   |               |
| <ol style="list-style-type: none"> <li>1. Arshdeep Bahga and Vijay K. Madisetti, "Internet of Things: A Hands-on Approach", Universities Press (India), 2015.</li> <li>2. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill, 2nd Edition, 2017.</li> </ol>  |               |
| <b>Reference Books:</b>  |               |

1. Shriram K. Vasudevan, Abhishek S., Sundar Balakrishnan, "Internet of Things", 1<sup>st</sup> Edition, Wiley, 2019.
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications ,2016  
Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, DavidBoyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1st Edition, Academic Press, 2015

### Course Outcomes\*\*

A student who successfully completes this course should be able to

1. Comprehend IoT fundamentals and apply IoT in real-world Scenarios
2. Differentiate IoT and M2M
3. Design and Develop IoT Devices

Integrate IoT with cloud and data Processing

### Course Articulation Matrix

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| CO2             | 3                        | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| CO3             | 3                        | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| CO4             | 3                        | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |

|                                   |                                    |                    |
|-----------------------------------|------------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC717E | <b>Multirate Signal Processing</b> | <b>Credits: 03</b> |
| L:T:P:-3:0:0                      |                                    | CIE Marks: 50      |
| Hours/Week: 03                    |                                    | SEE Marks: 50      |

|  |               |
|--|---------------|
| <b>UNIT-I</b>  | <b>10 Hrs</b> |
| Fundamentals of multirate systems: Basic multirate operations, interconnection of building polyphase representation, multistage implementation, applications of multirate systems, special filter banks, noble identities and their proof. |               |

|   |               |
|---|---------------|
| <b>UNIT-II</b>  | <b>10 Hrs</b> |
| Multirate filter banks: Maximally decimated filter banks, Errors created in QMF bank, alias system, power symmetric QMF banks, M channel filter banks, poly-phase representation reconstruction systems, alias free filter banks, tree structured filter banks, trans-multiplexers. |               |

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| <b>UNIT-III</b>   | <b>10 Hrs</b> |
| Para-unitary perfect reconstruction filter banks: Lossless transfer matrices, filter bank properties in para-unitariness, two channel paraunitary lattices, M-channel FIR Para-unitary QMF banks, coding. |               |

|  |               |
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| <b>UNIT-IV</b>   | <b>10 Hrs</b> |
| Linear phase perfect reconstruction QMF banks: Necessary conditions, lattice structures for linear phase FIR –PR, QMF banks, formal synthesis of linear phase FIR –PR ,QMF lattice. Cosine modulated filter banks: Pseudo QMF bank and its design. |               |

#### Reference Books

1. P. P. Vaidyanathan, - Multirate systems and filter banks, Pearson Education(Asia) Pvt, Ltd, 2004.
2. Gilbert Strang and Truong Ngujen, - Wavelets and filter banks, Wellesley Cambridge Press, 1996.
3. N.J.Fliege, -Multirate Digital Signal Processing, John Wiley & sons, USA, 2000.

#### Course Outcomes\*\*

##### After completion of the course student will be able to

1. Sample a signal at different rate and do transform domain analysis.
2. Design maximally decimated, QMF, polyphase, perfect reconstruction and tree structured filter banks.
3. Design Para-unitary perfect reconstruction, M-channel FIR para-unitary QMF filter banks.
4. Design linear phase perfect reconstruction, QM, cosine modulated and pseudo QMF filter banks.



### Course Articulation Matrix

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1</b>      | 3                        | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| <b>CO2</b>      | 3                        | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| <b>CO3</b>      | 3                        | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| <b>CO4</b>      | 3                        | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |

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|-----------------------------------|-----------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC710E | <b>Wavelets</b> | <b>Credits: 03</b> |
| L:T:P:-3:0:0                      |                 | CIE Marks: 50      |
| Hours/Week: 03                    |                 | SEE Marks: 50      |

| <b>UNIT-I</b>   | <b>10 Hrs</b> |
|---|---------------|
| <p><b>Fundamentals of Linear Algebra:</b> Vector spaces, Bases, Orthogonality, Orthonormality, Functions and function spaces, Orthogonal functions, Orthonormal functions, Orthogonal basis</p> <p><b>Short Time Fourier Transform (STFT):</b> Limitations of Fourier domain signal processing representation with continuous and discrete STFT, concept of time-frequency resolution, problem associated with STFT, Heisenberg's Uncertainty principle and time frequency tiling, Wavelet transform?</p> <p><b>Self Study Component:</b> Comparison between STFT and wavelet transform.</p>  |               |
| <b>UNIT-II</b>  | <b>10 Hrs</b> |
| <p><b>Introduction to Wavelet Transform:</b> The origins of wavelets, Wavelets and other wavelet like transform. History of wavelet from Morlet to Daubechies via Mallat, Different communities and family of wavelets. Different families of wavelets within wavelet communities.</p> <p><b>Continuous Wavelet Transform:</b> Wavelet transform-A first level introduction, Continuous versus discrete wavelet transform, frequency representation of signals, Properties of wavelets used in continuous wavelet transform. Continuous versus discrete wavelet transform</p> <p><b>Self Study Component:</b> Wavelet packet decomposition.</p> |               |
| <b>UNIT-III</b>   | <b>10 Hrs</b> |
| <p><b>Discrete Wavelet Transform:</b> Haar scaling functions and function spaces, Translation and scaling, Orthogonality of translates of <math>\phi(t)</math>, Function space <math>V_0</math>, Finer Haar scaling functions, Concepts of vector spaces, Haar wavelet function, Scaled and translated Haar wavelet functions, Orthogonality and <math>\psi(t)</math>, Normalization of Haar bases at different scales, Refinement relation with respect to bases, Support of a wavelet system, Daubechies wavelets, Plotting the Daubechies wavelets.</p> <p><b>Self Study Component:</b> Image compression using wavelets.</p>                |               |
| <b>UNIT-IV</b>  | <b>10 Hrs</b> |
| <p><b>Designing Orthogonal Wavelet Systems-A Direct Approach:</b> Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Condition-1: Unit area under scaling function, Condition-2: Orthonormality of translates of scaling functions, Condition-3: Orthonormality of scaling and wavelet functions, Condition-4: Approximation conditions (Smoothness conditions), Designing Daubechies orthogonal wavelet system coefficients, Constraints for Daubechies' 6 tap scaling function.</p> <p><b>Self Study Component:</b> Multi-resolution Analysis (MRA) using wavelets.</p>                                 |               |
| <b>Reference Books *</b>  |               |

1. K. P. Soman, K. I. Rmachandran, N. G. Resmi, “Insight into Wavelets: From Theory to Practice” (Third Edition), PHI Learning Pvt. Ltd., 2010.
2. A.N. Akansu and R.A. Haddad, “Multiresolution signal Decomposition: Transforms, Subbands and Wavelets”, Academic Press, Oranld, Florida, 1992.
3. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing”, Pearson Prentice Hall, 2007.
4. Rafael C. Gonzalez, Richard E. Woods “Digital Image Processing” (Third Edition), Pearson International Edition, 2009.
5. C. S. Burrus, Ramose and A. Gopinath, “Introduction to Wavelets and Wavelet Transform”, Prentice Hall Inc.

**Web links and Video Lectures (e-Resources):**

1. <http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html>
2. <http://www.wavelet.org/>
3. <http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.html>

**Course Outcomes\*\***

**After completion of the course student will be able to**

1. Compute STFT and time-frequency resolution.
2. Decompose a signal into different bands using different wavelets.
3. Plot different wavelets and do analysis.
4. Design Daubechies orthogonal wavelet system coefficients.

**Course Articulation Matrix**

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| CO2             | 3                        | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| CO3             | 3                        | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |
| CO4             | 3                        | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1  | -  | 1  | 3                                | 1 | - |

|                                   |                                   |                    |
|-----------------------------------|-----------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC713E | <b>Artificial Neural Networks</b> | <b>Credits: 03</b> |
| L:T:P – 3:0:0                     |                                   | CIE Marks: 50      |
| Total Hours/Week: 40hrs           |                                   | SEE Marks: 50      |

**Course objectives:**

1. To gain knowledge about the fundamentals of artificial neural networks.
2. To gain knowledge about single layer networks such as perceptron with supervised learning method.
3. To learn about the Backpropagation which is mostly used supervised learning algorithm for multilayer networks.
4. To learn about unsupervised learning networks which are used to discover special features and patterns from available data without using external help

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|--|----------------|
| <b>UNIT-I</b>  | <b>10 Hrs.</b> |
| <b>Introduction : History of Neural Networks, Structure and function of biological and artificial neuron, models of a neuron, Neural network architectures, Neural learning, Learning laws Applications of neural networks to solve tasks such as clustering and pattern association, Evaluation of Networks.</b>  |                |
| <b>UNIT-II</b>   | <b>10 Hrs.</b> |
| Supervised learning-I : Single layer networks: Supervised and unsupervised learning, Perceptrons, Linear separability, Perceptron training algorithm, Guarantee of success, Modifications, Support vector classification.  |                |
| <b>UNIT-III</b>  | <b>10 Hrs.</b> |
| <b>Supervised learning-II : Multi layer networks: Multi level discrimination, Preliminaries, Backpropagation algorithm, Classification using Backpropagation, setting the parameter values, Radial basis functions, Support vector machines, Probabilistic neural network, Polynomial networks</b>   |                |
| <b>UNIT-IV</b>   | <b>10 Hrs.</b> |
| <b>Unsupervised learning : Winner - Take - all networks, Learning vector quantizers, Counter propagation networks, Adaptive Resonance Theory, Topologically organized networks, Distance based learning, Principal component analysis networks.</b>  |                |
| <b>Reference Books *</b>   |                |
| <b>Reference Books</b>   |                |
| <ol style="list-style-type: none"> <li>1. Kishan Mehrotra, Chelkuri K. Mohan, Sanjay Ranka - Elements of Artificial Neural Networks, Penram International, 2001.</li> <li>2. B. Yegnanarayana - Artificial Neural Networks, PHI, New Delhi, 1999.</li> <li>3. J.M. Zurada - Introduction to Artificial Neural Systems, Jaico Publications, India,1994.</li> <li>4. Rajasekharan and Pai - Neural Networks, Fuzzy Logic and Genetic algorithms: synthesis and applications, PHI Publication, 2003.</li> </ol> |                |
| Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.  |                |

**Web links and Video Lectures (e-Resources):**

1. <https://nptel.ac.in/courses/117105084>

<https://ocw.mit.edu/courses/9-641j-introduction-to-neural-networks-spring-2005/>

**Course Outcomes\*\***

After completion of the course student will be able to

1. Enlighten fundamentals of neural networks, learning laws and their applications
2. Train the neural networks to solve linear separability with perceptions and also to understand support vector classification
3. Analyze Back propagation algorithm and setting the parameter values
4. Comprehend about the clustering process using neural networks such as counter propagation networks and Adaptive Resonance Theory

\* **Books to be listed as per the format with decreasing level of coverage of syllabus**

\*\* **Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes  | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|--|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|  | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| <b>CO1:</b> Enlighten fundamentals of neural networks, learning laws and their applications  | 2                        | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2  | 1  | 2  | 1                                | 0 | 1 |
| <b>CO2:</b> Train the neural networks to solve linear separability with perceptions and also to understand support vector classification     | 2                        | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 2  | 1  | 0  | 2                                | 0 | 2 |
| <b>CO3:</b> Analyze Back propagation algorithm and setting the parameter values  | 1                        | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 2  | 1  | 0  | 2                                | 0 | 2 |
| <b>CO4:</b> Comprehend about the clustering process using neural networks such as counter propagation networks and Adaptive Resonance Theory | 1                        | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 3  | 1  | 0  | 1                                | 0 | 2 |

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|-----------------------------------|--|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC714E | <b>Cryptography and Network Security</b> | <b>Credits: 03</b> |
| L:T:P – 3:0:0                     |  | CIE Marks: 50      |
| Total Hours/Week:<br>40hrs        |  | SEE Marks: 50      |

The objectives of this course are to:

1. Impart the foundational knowledge in network security, OSI security architecture, encryption techniques, and DES for securing networked systems.
2. Explain block cipher operations and public-key cryptography
3. Provide expertise in cryptographic hash functions, MACs, and digital signatures for ensuring data integrity and authentication.

Provide expertise in key management, distribution methods, X.509 certificates, and transport layer security protocols like TLS, HTTPS, and SSH.

|   |                |
|---|----------------|
| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| Introduction to Network Security: OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security.<br>Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.<br>Data Encryption Standard (DES): DES Encryption and Decryption, Strength of DES, Block Cipher Design Principles. |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode.<br>Public-Key Cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange.   |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| Cryptographic Hash Functions: Two Simple Hash Functions, Requirements and Security, Hash function Based on Cipher Block Chaining, Secure Hash Algorithm. Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MAC Based on Hash Functions: Digital Signatures.             |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| Key Management and Distributions: Symmetric Key Distribution using Symmetric Encryption, Symmetric Key Distribution using Asymmetric Encryption, Distribution of Public Keys. X.509 Certificates, Transport Layer Security: Web Security Considerations, Transport Layer Security, HTTPS, Secure Shell (SSH).   |                |
| <b>Reference Books *</b>  |                |
| <b>Textbooks :</b><br>1. William Stallings, “ <b>Cryptography and Network Security, Principles and Practice</b> ”, 7th edition, Pearson/ Prentice Hall, 2017.   |                |
| <b>Reference Book:</b><br>1. Atul Kahate, “ <b>Cryptography and Network Security</b> ”, 4th edition, Tata McGraw Hill, 2020.<br>2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, “ <b>Cryptography and Network Security</b> ”, 2 <sup>nd</sup> edition, Tata McGraw Hill, 2011.  |                |
| <b>Course Outcomes**</b>  |                |
| <b>After completion of the course student will be able to</b><br>A student who successfully completes this course should be able to:  |                |
| <ol style="list-style-type: none"> <li>1. Acquire network security essentials, covering OSI architecture, security mechanisms, encryption techniques and block cipher design.</li> <li>2. Develop proficiency in block cipher operations and public-key cryptography principles.</li> </ol>   |                |

- 3. Excel in cryptographic hash functions, cipher block chaining, Secure Hash Algorithm, message authentication functions, MAC security and digital signatures.
- 4. Excel in key management methods, symmetric and asymmetric key distribution, X.509 certificates, and transport layer security protocols like TLS, HTTPS, and SSH.

**\* Books to be listed as per the format with decreasing level of coverage of syllabus**

**\*\* Each CO to be written with proper action word and should be assessable and quantifiable**

| Course Outcomes   | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|---|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|   | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1: Acquire network security essentials, covering OSI architecture, security mechanisms, encryption techniques and block cipher design.                              | 3                        | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO2: Develop proficiency in block cipher operations and public-key cryptography principles.   | 3                        | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO3: Excel in cryptographic hash functions, cipher block chaining, Secure Hash Algorithm, message authentication functions, MAC security and digital signatures       | 3                        | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO4: Excel in key management methods, symmetric and asymmetric key distribution, X.509 certificates, and transport layer security protocols like TLS, HTTPS, and SSH. | 3                        | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

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| <b>SUBJECT CODE:</b><br>21UEC712E | <b>Operating Systems</b> | <b>Credits: 03</b> |
| L:T:P – 3:0:0                     |                          | CIE Marks: 50      |
| Total Hours/Week: 40hrs           |                          | SEE Marks: 50      |

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| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| <p><b>Introduction:</b> What Operating System Do, User View, System View, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security.</p> <p><b>System Structures:</b> Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure.</p> <p><b>Process Management:</b> Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication.</p> <p><b>Multithreaded Programming:</b> Overview, Multicore Programming, Multithreading Models.</p> |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| <p><b>Process Scheduling:</b> Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling.</p> <p><b>Process Synchronization:</b> Background, The Critical-Section Problem, Peterson’s Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.</p> <p><b>Deadlocks:</b> System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.</p>   |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| <p><b>Memory-Management Strategies:</b> Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.</p> <p><b>Virtual-Memory Management:</b> Background, Demand Paging, Page Replacement, Allocation of Frames.</p> <p><b>File system:</b> File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing.</p>   |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| <p><b>Implementing File-Systems:</b> File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.</p> <p><b>Mass-Storage Structure:</b> Overview of Mass-Storage Structure. Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management.</p> <p><b>System Protection and Security:</b> Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, The Security Problem, Program Threats.</p>   |                |
| <b>Reference Books *</b>  |                |
| <b>Textbook:</b>  |                |
| <ol style="list-style-type: none"> <li>1. Abraham Silberschatz , Peter B. Galvin, Greg Gagne, ” <b>Operating System Concepts</b>”, 9<sup>th</sup> edition, Wiley India, 2016 .</li> </ol>   |                |



**Reference Books:**

1. Dhananjay M. Dhamdhere," **Operating Systems-A Concept Based Approach**", 3<sup>rd</sup> edition, Tata McGraw-Hill, 2012.
2. P.C.P.Bhatt," **Operating Systems**",2<sup>nd</sup> edition, PHI,2007.
3. William Stallings," **Operating Systems: Internals and Design Principles**",6<sup>th</sup> edition, Pearson, 2009.

**Course Outcomes\*\*****After completion of the course student will be able to**

5. Describe the operating system structure, operations, services, design, thread and various features of process including scheduling, creation, termination, communication and explore inter process communication .
6. Discuss various CPU scheduling algorithms , several tools used to solve process synchronisation problems and also number of different methods for preventing or avoiding deadlocks.
7. Explore various memory management techniques and aspects related to file system.
8. Describe file system implementation, mass storage structure and protection

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 2 | - | 3 | 2 |   |   |   |    |    |    | 3                                |   |   |
| CO2             | 3                        | 2 | 3 | - | 3 | 1 |   |   |   |    |    |    | 3                                |   |   |
| CO3             | 3                        | 2 | 3 | - | 3 | - |   |   |   |    |    |    | 3                                |   |   |
| CO4             | 2                        | 1 | 1 | - | 3 | 1 |   |   |   |    |    |    | 3                                |   |   |

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| <b>SUBJECT CODE:</b><br>21UEC715E  | <b>IC Technology</b> | <b>Credits: 03</b> |
| L:T:P – 3:0:0  |                      | CIE Marks: 50      |
| Total Hours/Week: 40hrs  |                      | SEE Marks: 50      |
| <b>UNIT-I</b>  |                      | <b>10 Hrs.</b>     |
| <p><b>Crystal Growth and Silicon Wafer Preparation:</b> Introduction, Semiconductor Silicon Preparation, Silicon Wafer Preparation Stages, Crystalline Materials, Unit Cells, Poly and Single Crystals, Crystal Orientation, Crystal Growth, Czochralski Method, Liquid-Encapsulated Czochralski, Float Zone, Crystal and Wafer Quality, Point Defects, Dislocations, Growth Defects, Wafer Preparation, End Cropping, Diameter Grinding, Crystal Orientation, Conductivity, and Resistivity Check, Grinding Orientation Indicators, Wafer Slicing, Wafer Marking, Rough Polish, Chemical Mechanical Polishing, Backside Processing, Double-Sided Polishing, Edge Grinding and Polishing, Wafer Evaluation, Oxidation, Packaging, Wafer Types and Uses.</p> <p><b>Overview of Wafer Fabrication and Packaging:</b> Introduction, Goal of Wafer Fabrication, Wafer Terminology, Chip Terminology, Basic Wafer-Fabrication Operations, Layering, Patterning, Circuit Design, Reticle and Masks, Doping, Heat Treatments, Example Fabrication Process, Wafer Sort, Packaging.</p> <p><b>Contamination Control:</b> Introduction, The Problem Contamination-Caused Problems, Contamination Sources, General Sources Air Clean Air Strategies Cleanroom Workstation Strategy Tunnel or Bay Concept Micro-and Mini-Environments Temperature, Humidity, and Smog. Cleanroom Construction, Construction Materials Cleanroom Elements Personnel-Generated Contamination Process Water Process Chemicals Equipment. Cleanroom Materials and Supplies, Cleanroom Maintenance, Wafer Surface Cleaning, Particulate Removal Wafer Scrubbers High-Pressure Water Cleaning Organic Residues Inorganic Residues Chemical-Cleaning Solutions General Chemical Cleaning Oxide Layer Removal Room Temperature and Ozonated Chemistries Water Rinsing Drying Techniques Contamination Detection.</p> |                      |                    |
| <b>UNIT-II</b>   |                      | <b>10 Hrs.</b>     |
| <p><b>Oxidation:</b> Introduction, Silicon Dioxide Layer Uses, Surface Passivation Doping Barrier Surface Dielectric Device Dielectric (MOS Gates) Device Oxide Thicknesses, Thermal Oxidation Mechanisms, Influences on the Oxidation Rate Thermal Oxidation Methods Horizontal Tube Furnaces Temperature Control System Source Cabinet Vertical Tube Furnaces Rapid Thermal Processing High-Pressure Oxidation Oxidant Sources, Oxidation Processes, Preoxidation Wafer Cleaning, Postoxidation Evaluation, Surface Inspection Oxide Thickness Oxide and Furnace Cleanliness Thermal Nitridation.</p> <p><b>The Ten-Step Patterning Process-Surface Preparation to Exposure:</b> Introduction, Overview of the Photomasking Process, Ten-Step Process, Basic Photoresist Chemistry, Photoresist, Photoresist Performance Factors, Resolution Capability Adhesion Capability Process, Latent Pinholes Particle and Contamination Levels Step Coverage Thermal Flow Comparison of Positive and Negative Resists. Physical Properties of Photoresists, Solids Content Viscosity Surface Tension Index of Refraction Storage and Control of Photoresists Light and Heat Sensitivity Viscosity Sensitivity Shelf Life Cleanliness. Photomasking Processes Surface Preparation to Exposure, Surface Preparation, Particle Removal Dehydration Baking Wafer Priming Spin Priming Vapor Priming, Photoresist Application (Spinning). The Static Dispense Spin Process Dynamic Dispense Moving-Arm Dispensing Manual Spinners Automatic Spinners Edge Bead Removal Backside Coating.</p>  |                      |                    |
| <b>UNIT-III</b>  |                      | <b>10 Hrs.</b>     |
| <p>Soft Bake, Convection Ovens Manual Hot Plates In-Line, Single-Wafer Hot Plates Moving-Belt Hot Plates Moving-Belt Infrared Ovens Microwave Baking Vacuum Baking, Alignment and Exposure, Alignment and Exposure Systems Exposure Sources Alignment Criteria Aligner Types Post exposure Bake, Advanced Lithography.</p>   |                      |                    |

**The Ten-Step Patterning Process-Developing to Final Inspection:** Introduction, Development Positive Resist Development Negative Resist Development Wet Development Processes Dry (or Plasma) Development , Hard Bake, Hard-Bake Methods Hard-Bake Process Develop Inspect Develop Inspect Reject Categories Develop Inspect Methods Causes for Rejecting at the Develop Inspection Stage. Etch, Wet Etching, Etch Goals and Issues Incomplete Etch Overetch and Undercutting Selectivity Wet-Spray Etching Silicon Wet Etching Silicon Dioxide Wet Etching Aluminum-Film Wet Etching Deposited-Oxide Wet Etching Silicon Nitride Wet Etching Vapor Etching. Dry Etch, Plasma Etching Etch Rate Radiation Damage Selectivity Ion-Beam Etching Reactive Ion Etching. Resist Effects in Dry Etching, Resist Stripping, Wet Chemical Stripping of Nonmetallized Surfaces Wet Chemical Stripping of Metallized Surfaces Dry Stripping Post-Ion Implant and Plasma Etch Stripping, New Stripping Challenges Final Inspection Mask Making

**Doping:** Introduction, The Diffusion Concept, Formation of a Doped Region and Junction, The N-P Junction Doping Process Goals Graphical Representation of Junctions Concentration versus Depth Graphs Lateral Diffusion, Same-Type Doping Diffusion, Process Steps Deposition, Lateral Diffusion Same-Type Doping

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|----------------|----------------|
| <b>UNIT-IV</b> | <b>10 Hrs.</b> |
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Dopant Sources Drive-In Oxidation, Oxidation Effects Introduction to Ion Implantation Concept of Ion Implantation. Ion-Implantation System, Implant Species Sources. Ionization Chamber Mass Analyzing or Ion Selection Acceleration Tube Wafer Charging Beam Focus Neutral Beam Trap Beam Scanning EndStation and Target Chamber Ion-Implant Masks Dopant Concentration in Implanted Regions Crystal Damage Annealing and Dopant Activation Channeling Evaluation of Implanted Layers Uses of Ion Implantation. The Future of Doping.

**Layer Deposition:** Introduction, Film Parameters, Chemical Vapor Deposition Basics, Basic CVD System Components CVD Process Steps CVD System Types, Atmospheric-Pressure CVD Systems Horizontal-Tube Induction-Heated APCVD Barrel Radiant-Induction-Heated APCVD Pancake Induction-Heated APCVD Continuous Conduction-Heated APCVD Horizontal Conduction-Heated APCVD Low-Pressure Chemical Vapor Deposition Horizontal Conduction-Convection-Heated LPCVD Ultra-High Vacuum CVD Plasma-Enhanced CVD (PECVD) High-Density Plasma CVD Atomic Layer Deposition Vapor-Phase Epitaxy Molecular Beam Epitaxy Metalorganic CVD Deposited Films Deposited Semiconductors Epitaxial Silicon Polysilicon and Amorphous Silicon Deposition SOS and SOI Gallium Arsenide on Silicon Insulators and Dielectrics Silicon Dioxide Doped Silicon Dioxide Silicon Nitride High-k and Low-k Dielectrics Conductors

**Metallization:** Introduction, Deposition Methods Single-Layer Metal Systems Multilevel Metal Schemes Conductors Materials Aluminum Aluminum-Silicon Alloys Aluminum-Copper Alloy Barrier Metals Refractory Metals and Refractory Metal Silicides Plugs Sputter Deposition Copper Dual-Damascene Process Low-k Dielectric Materials The Dual-Damascene Copper Process Barrier or Liner Deposition Seed Deposition Electrochemical Plating Chemical-Mechanical Processing CVD Metal Deposition Doped Polysilicon CVD Refractory Deposition Metal-Film Uses MOS Gate and Capacitor Electrodes Backside Metallization Vacuum Systems Dry Mechanical Pumps Turbomolecular Hi-Vac Pumps.

|                          |
|--------------------------|
| <b>Reference Books *</b> |
|--------------------------|

**Text Books**

1. Peter Van Zant, Microchip Fabrication, A Practical Guide to Semiconductor Processing, Sixth Edition, McGraw Hill

**Reference Books**

1. S.K.Gandhi, VLSI Fabrication principles, Wiley.
2. S.M. Sze, VLSI Technology, II edition, McGraw Hill.

3. W.R. Runyan, Silicon Semiconductor Technology, McGraw Hill

**Course Outcomes\*\***

**After completion of the course student will be able to**

1. Understand the basic steps of fabrication, wafer preparation, Crystal growth and packaging.
2. Understands the effect of contaminations on device processing, device performance.
3. Understands the uses of formation and process of silicon dioxide growth, Photoresist, wet etching and dry etching
4. To learn different types oxidation such as Chemical vapor Deposition, and LPCVD of poly silicon. Oxidation, Kinetics of oxidation.

\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 3 | 2 | - | 2 | 2 | - | - | - | -  | -  | -  |                                  |   |   |
| CO2             | 3                        | 2 | 3 | - | 2 | 1 | - | - | - | -  | -  | -  |                                  |   |   |
| CO3             | 3                        | 2 | 3 | - | 3 | - | - | - | 1 | -  | -  | -  |                                  |   |   |
| CO4             | 2                        | 1 | 1 | - | 2 | 1 | - | - | 1 | -  | -  | 1  |                                  |   |   |

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|--|--------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br><b>21UEC705E</b> | <b>Satellite Communication</b> | <b>Credits: 03</b> |
| L:T:P –3-0-0                             |                                | CIEMarks:50        |
| Total Hours/Week: 03                     |                                | SEEMarks:50        |

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| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| <p>Overview of Satellite Systems: Frequency Allocations for Satellite Services. INTELSAT 4, U.S.Domsats 9 ,Polar Orbiting Satellites 12,Argos System 18, Cospas-Sarsat.</p> <p>Orbits and Launching Methods: Kepler’s First Law, Kepler’s Second Law, Kepler’s Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Perturbations, The subsatellite point, Predicting satellite position, Local Mean Solar Time and Sun-Synchronous Orbits, Problems. Launches and Launch Vehicles, Expendable Launch Vehicles (ELVs),Placing Satellites into Geostationary Orbit, Orbital Effects in Communications Systems Performance.</p> |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| <p>The Geostationary Orbit: Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Problems.</p> <p>RadioWavePropagation:AtmosphericLosses,IonosphericEffects,RainAttenuation,Other Propagation Impairments,</p> <p>Polarization: Antenna Polarization, Polarization of Satellite Signals, Cross-Polarization Discrimination, Ionospheric Depolarization, Rain Depolarization, Ice Depolarization.</p>  |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| <p>The Space Segment: The Power Supply, Attitude Control, Spinning Satellite stabilization, Momentum Wheel stabilization, Station Keeping, Thermal Control, TT&amp;C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier Communications Subsystems: Description of the Communications System, Transponders, Satellite Antennas, Basic Antenna Types and Relationships, Example Global Beam Antenna Example Regional Coverage Antenna, Satellite Antennas in Practice, Equipment Reliability and Space</p>  |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |
| <p>Low Earth Orbit and Non-Geostationary Satellite Systems: Orbit Considerations, Coverage Frequency &amp; Considerations, Delay Throughput Considerations, System Considerations Operational NGSO Considerations Designs,</p>  |                |

Satellite Navigation and the Global Positioning System: Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, Timing Accuracy, GPS C/A Code Accuracy, Differential GPS.

**Reference Books \***

**Textbook:**

1. Dennis Roddy, "Satellite Communications", 4<sup>th</sup> edition, McGraw-Hill International Edition, 2010.

**Reference Books:**

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", 2<sup>nd</sup> edition, John Wiley & Sons, 2003.
2. Wilbur L. Pritchard, Hendri. Suyderhoud, Rober A. Nelson, "Satellite Communication System Engineering", Prentice Hall, Second edition 1993.

**Course Outcomes\*\***

After completion of the course student will be able to

1. How to describe the motion of satellite in the orbit.
2. Describe the concepts of subsystems, link design, rain fading and link availability.
3. Explain modulation techniques and the performance of satellite communication systems
4. Analyze the design requirements and the performance of satellite communication systems.

\*Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |    |    |    | Program Specific Outcomes (PSOs) |   |   |
|-----------------|--------------------------|---|---|---|---|---|---|---|---|----|----|----|----------------------------------|---|---|
|                 | 1                        | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1                                | 2 | 3 |
| CO1             | 3                        | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO2             | 3                        | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO3             | 3                        | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |
| CO4             | 3                        | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0  | 0  | 3                                | 0 | 0 |

|                                   |                                  |                    |
|-----------------------------------|----------------------------------|--------------------|
| <b>SUBJECT CODE:</b><br>21UEC709C | <b>Human Resource Management</b> | <b>Credits: 03</b> |
| L:T:P – 3-0-0                     |                                  | CIE Marks: 50      |
| Total Hours/Week: 03              |                                  | SEE Marks: 50      |

**Course Objectives:**

**The objectives of this course are to:**

1. **Examine** the fundamental principles of Human Resource Management and its evolving role in modern business environments, focusing on the functions of HRM and effective procurement strategies
2. **Evaluate** training and development methods, performance appraisal techniques, and career development strategies in human resource management, emphasizing their impact on organizational effectiveness.
3. **Analyze** variable compensation structures also examining the importance of industrial relations and collective bargaining processes in maintaining a harmonious work environment.
4. **Examine** the complexities of International Human Resource Management (IHRM) and its impact on global business operations, focusing on international staffing, compensation strategies, and labor relations.

|   |                |
|---|----------------|
| <b>UNIT-I</b>   | <b>10 Hrs.</b> |
| <b>Introduction:</b> Nature of Human Resource Management (HRM), importance of human resource management, functions of human resource management, The changing environment of HRM and role of HRM in changing business scenario. <b>Procurement:</b> Job, job analysis, job description and job specifications, Man power Planning demand and supply forecasting, recruitment, methods of recruitment, Employees testing and selection, types of psychological tests and interviews, placement and induction.  |                |
| <b>UNIT-II</b>  | <b>10 Hrs.</b> |
| <b>Development:</b> Operative training and management development, methods of training and development. <b>Performance Appraisal:</b> Traditional and modern Methods. <b>Career Development:</b> career anchors, career development programme and the modern career problems. <b>Compensation:</b> Factor affecting compensation policy, job evaluation, methods of job evaluation.   |                |
| <b>UNIT-III</b>   | <b>10 Hrs.</b> |
| <b>Variable Compensation:</b> Individual & group, supplementary compensation-fringe benefits and current trends in compensation. <b>Integration:</b> Human relation, importance of industrial relations, causes and effects of Industrials disputes, Machinery for settlement of industrial disputes in India, Role of trade unions in maintaining relations. <b>Collective Bargaining:</b> concept, features, process and advantages. <b>Maintenance and separation:</b> Employee safety, health and welfare, Provisions under factory Act, 1948, Turnover, Retirement and Layoff. |                |
| <b>UNIT-IV</b>  | <b>10 Hrs.</b> |

**International HRM:** The growth of international business, HR and the international business challenge, effect of inter country difference on HRM, international staffing, international compensation and appraisal, international labor relations and Information Technology and HR.

**Reference Books \***

**Textbooks :**

1. Flippo Edwin B, "Personnel Management", 6th Edition, McGraw Hills 2000.
2. Dresler Garry, "Human Resource Management", 8th Edition, Pearson Education, New Delhi 2002.

**Reference Book:**

1. Memoria C B, "Personnel Management (Management of HRM)", Himalaya Publication, New Delhi 1999.

**Course Outcomes\*\***

**A student who successfully completes this course should be able to:**

1. **Analyze** job roles and specifications, conduct manpower planning, and effective recruitment and selection methods, including various psychological tests and interviews
2. **Compare** traditional and modern performance appraisal methods, **design** effective training and development programs, and **assess** compensation policies and job evaluation methods
3. **Evaluate** compensation trends and fringe benefits, **assess** the role of trade unions in industrial relations, and effective collective bargaining strategies to address workplace issues
4. **Analyze** the influence of inter-country differences on HR practices and **design** effective international HR strategies that address staffing, compensation, and labor relations challenges



\* Books to be listed as per the format with decreasing level of coverage of syllabus

\*\* Each CO to be written with proper action word and should be assessable and quantifiable

| Course Outcomes   | Programme Outcomes (POs) |   |   |   |   |   |   |   |   |   |   |   | Program Specific Outcomes (PSOs) |   |   |
|---|--------------------------|---|---|---|---|---|---|---|---|---|---|---|----------------------------------|---|---|
|   | a                        | b | c | d | e | f | g | h | i | j | k | l | m                                | n | o |
| CO1: <b>Analyze</b> job roles and specifications, conduct manpower planning, and effective recruitment and selection methods, including various psychological tests and interviews                          | 0                        | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0                                | 0 | 0 |
| CO2: <b>Compare</b> traditional and modern performance appraisal methods, <b>design</b> effective training and development programs, and <b>assess</b> compensation policies and job evaluation methods     | 0                        | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0                                | 0 | 0 |
| CO3: <b>Evaluate</b> compensation trends and fringe benefits, <b>assess</b> the role of trade unions in industrial relations, and effective collective bargaining strategies to address workplace issues    | 0                        | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0                                | 0 | 0 |
| CO4: <b>Analyze</b> the influence of inter-country differences on HR practices and <b>design</b> effective international HR strategies that address staffing, compensation, and labor relations challenges. | 0                        | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0                                | 0 | 0 |