# VASAVI COLLEGE OF ENGINEERING
## (AUTONOMOUS)

ACCREDITED BY NAAC WITH 'A++' GRADE
Ibrahimbagh, Hyderabad-31
Approved by A.I.C.T.E., New Delhi and
Affiliated to Osmania University, Hyderabad-07

**Sponsored**
**by**
**VASAVI ACADEMY OF EDUCATION**
**Hyderabad**

**SCHEME OF INSTRUCTION AND SYLLABI UNDER CBCS FOR**
**B.E. (ECE) VII and VIII Semesters**
**With effect from 2025-26**
**(For the batch admitted in 2022-23)**
**(R-22)**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
Phones: +91-40-23146040, 23146041
Fax: +91-40-23146090

## Institute Vision

Striving for a symbiosis of technological excellence and human values

## Institute Mission

To arm young brains with competitive technology and nurture holistic development of the individuals for a better tomorrow

## Department Vision

Striving for excellence in teaching, training and research in the areas of Electronics and Communication Engineering and fostering ethical values

## Department Mission

To inculcate a spirit of scientific temper and analytical thinking and train the students in contemporary technologies in Electronics and Communication Engineering to meet the needs of the industry and society with ethical values

| B.E (ECE) Program Educational Objectives (PEO's) | |
|---|---|
| **PEO I** | Graduates will be able to identify, analyze and solve engineering problems. |
| **PEO II** | Graduates will be able to succeed in their careers, higher education, and research. |
| **PEO III** | Graduates will be able to excel individually and in multidisciplinary teams to solve industry and societal problems. |
| **PEO IV** | Graduates will be able to exhibit leadership qualities and lifelong learning skills with ethical values. |

| B.E. (ECE) PROGRAM OUTCOMES (PO's)<br>Engineering Graduates will be able to: | |
|---|---|
| **PO1** | Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| **PO2** | Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. |
| **PO3** | Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations. |
| **PO4** | Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions. |
| **PO5** | Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO6** | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO7** | Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. |
| **PO8** | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO9** | Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings. |
| **PO10** | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive clear instructions. |
| **PO11** | Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO12** | Lifelong learning: Recognize the need, and for have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change. |

| B.E (ECE) PROGRAM SPECIFIC OUTCOMES (PSO's) | |
|---|---|
| **PSO I** | ECE students will be able to analyze and offer circuit and system level solutions for complex electronics engineering problems, keeping in mind the latest technological trends. |
| **PSO II** | ECE students will be able to apply the acquired knowledge and skills in modeling and simulation of communication systems. |
| **PSO III** | ECE students will be able to implement signal and image processing techniques for real time applications. |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS) :: IBRAHIMBAGH, HYDERABAD – 500 031.
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHEME OF INSTRUCTION AND EXAMINATION **(R-22)** :: B.E. - ECE : SEVENTH SEMESTER (2025 - 26)

| **B.E (ECE) VII - Semester** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course Code** | **Name of the Course** | **Scheme of Instruction** | | | **Scheme of Examination** | | | **Credits** |
| | | **Hours per Week** | | | **Duration in Hrs** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | | **SEE** | **CIE** | |
| **THEORY** | | | | | | | | |
| U22PC710EC | Microwave Engineering | 3 | - | - | 3 | 60 | 40 | **3** |
| U22PC720EC | VLSI Design | 3 | - | - | 3 | 60 | 40 | **3** |
| U22PE7XXEC | Professional Elective – I | 3 | - | - | 3 | 60 | 40 | **3** |
| U22PE7XXEC | Professional Elective – II | 3 | - | - | 3 | 60 | 40 | **3** |
| **PRACTICALS** | | | | | | | | |
| U22PC711EC | Microwave Engineering Lab | - | - | 2 | 3 | 50 | 30 | **1** |
| U22PC721EC | VLSI Design Lab | - | - | 2 | 3 | 50 | 30 | **1** |
| U22PE7XXEC | Professional Elective – I Lab | - | - | 2 | 3 | 50 | 30 | **1** |
| U22PE7XXEC | Professional Elective – II Lab | - | - | 2 | 3 | 50 | 30 | **1** |
| U22PW719EC | Project Seminar | - | - | 2 | - | - | 30 | **1** |
| NPTEL Certification Course: 8 or 12 weeks duration | | - | - | - | - | - | - | **2** |
| **TOTAL** | | **12** | **-** | **10** | **-** | **440** | **310** | **19** |
| **GRAND TOTAL** | | **22** | | | | **750** | | |

**B.E (ECE) VII & VIII - Semester for the Academic Year 2025 - 2026**

## Professional Electives (R-22)

(Students can opt for all professional electives from single stream or several streams)

| Professional Elective Stream | Embedded Systems and VLSI Stream | | Communication Engineering Stream | | Signal Processing Stream | | Networking Stream | |
|---|---|---|---|---|---|---|---|---|
| **Semester - VII** | | | | | | | | |
| **Professional Elective – I (Theory courses)** | U22PE710EC | Advanced Embedded Systems | U22PE720EC | Software Defined Radio and its Applications | U22PE730EC | Artificial Neural Networks | U22PE740EC | Voice and Data Networks |
| **Professional Elective – I (Lab courses)** | U22PE711EC | Advanced Embedded Systems Lab | U22PE721EC | Software Defined Radio and its Applications Lab | U22PE731EC | Artificial Neural Networks Lab | U22PE741EC | Voice and Data Networks Lab |
| **Professional Elective – II (Theory courses)** | U22PE750EC | IoT Architectures and Protocols | U22PE760EC | Wireless Communications | U22PE770EC | Digital Image and Video Processing | U22PE780EC | Cryptography and Network Security |
| **Professional Elective – II (Lab courses)** | U22PE751EC | IoT Architectures and Protocols Lab | U22PE761EC | Wireless Communications Lab | U22PE771EC | Digital Image and Video Processing Lab | U22PE781EC | Cryptography and Network Security Lab |
| **Semester - VIII** | | | | | | | | |
| **Professional Elective – III** | U22PE810EC | Real Time Systems | U22PE820EC | Satellite Communication | U22PE830EC | Image and Video processing using Machine Learning | U22PE840EC | Wireless Sensor Networks |
| | U22PE811EC | Low Power VLSI Design | U22PE821EC | Optical Fiber Communication | U22PE831EC | Speech and Audio Signal Processing | U22PE841EC | Optical Networks |
| **Professional Elective – IV** | U22PE850EC | Industrial IoT and Applications | U22PE860EC | Radar and Navigation Systems | U22PE870EC | Language Models and Applications | U22PE880EC | Blockchain Technology and its Applications |
| | U22PE851EC | FPGA Architectures and Applications | U22PE861EC | Global Positioning System | U22PE871EC | Adaptive Signal Processing | U22PE881EC | Network Management |
| | | | U22PE862EC | Coding Theory and Techniques | U22PE872EC | Biomedical Signal Processing | | |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Microwave Engineering

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PC710EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Analyze and design the field components of waveguides<br>2. Understand and analyze the working of circular waveguides, cavity resonators, and microstrip line structures.<br>3. Formulating the S parameters of Microwave components<br>4. Understanding the power output and efficiency characteristics of Microwave sources<br>5. Familiar with negative resistance and avalanche effect solid state devices | On completion of the course, students will be able to<br>1. Anlayze the E and H field components of parallel and rectangular waveguides.<br>2. Describe the characteristics and applications of circular waveguides and cavity resonators.<br>3. Analyze the scattering parameters of microwave components.<br>4. Summarize the characteristics of Microwave sources.<br>5. Describe the characteristics of microwave solid-state devices. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | 2 | | | | | | 2 | | 3 | |
| CO2 | 3 | 3 | 2 | | | 2 | | | | | | 2 | | 3 | |
| CO3 | 3 | 3 | | | | 2 | | | | | | 2 | | 3 | |
| CO4 | 3 | 2 | | | | 2 | 3 | | | | | 2 | | 3 | |
| CO5 | 2 | 2 | | | | 2 | | | | | | 2 | | 3 | |

**UNIT-I :**

Introduction to Parallel plane waveguides, Wave Guides: TE and TM waves in rectangular waveguides, Wave Impedance, Characteristic Impedance, Attenuation in wave guides.

**UNIT-II:**

Introduction to Circular wave guides, Cavity resonators, resonant frequency, Applications of cavity resonators. Slotted wave guide structures, Elements of strip lines and micro strip lines. Design analysis of microstrip lines

**UNIT-III:**

Microwave Circuits and Components: Concept of Microwave circuit, Normalized voltage and currents, Introduction to scattering parameters and their properties, Reciprocal and Non-reciprocal components: E and H Plane Tees, Magic Tee Directional coupler, Attenuators, Phase Shifters, Isolators and circulators S parameters for and their properties. Estimation of waveguide parameters for different modes of operation using AI

**UNIT-IV:**

Microwave Tubes: High frequency limitations of conventional tubes, Bunching and velocity modulation, mathematical theory of bunching, principles and operation of two cavity, multi cavity, Reflex Klystron. Principle and operation of magnetrons, TWT.

**UNIT-V:**

Microwave Solid State Devices: Principles of operation, characteristics and applications of Varactor, PIN diode, GUNN diode and IMPATT diode

**Learning Resources:**


1. Samuel Y. Liao, Microwave Devices and Circuits, 3rd ed, Pearson, 2003.
2. Edward C. Jordon, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2015, Pearson, 2nd Edition.
3. R.E. Collins, "Foundations of Microwave Engineering", II edition, Wiley, 2001.
4. K.C. Gupta "Microwaves", John Wiley & Sons, 2012
5. Annapurna Das, Sisir K. Das, "Microwave Engineering" Tata McGraw-Hill Education, 2000
6. https://swayam.gov.in/nd1_noc19_ee57
7. https://swayam.gov.in/nd1_noc19_ee68


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# VLSI Design

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PC720EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Understand different Inverter configurations.<br>2. Identify different CMOS fabrication process.<br>3. Evaluate the performance pf CMOS sub system Design.<br>4. Analyze the design of Basic Memory Cells.<br>5. Understand the importance of Testing in VLSI Design. | On completion of the course, students will be able to<br>1. Explain the performance characteristics of Inverters.<br>2. Analyze MOS layers for CMOS fabrication.<br>3. Compare different performance characteristics of High speed Adders.<br>4. Illustrate the need of memory cells and their applications.<br>5. Apply various tests for VLSI Circuits at different levels. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | | |
| CO2 | 2 | 3 | 2 | 3 | | | | | | | | | 3 | | |
| CO3 | 2 | 2 | 3 | | | | | | | | | | 3 | 1 | 1 |
| CO4 | 2 | 1 | 2 | | | | | | | | | | 3 | | |
| CO5 | 2 | 2 | 3 | | | | | | | | | 2 | 3 | 1 | 1 |

**UNIT-I :**

**Review of electrical characteristics of MOSFET:** CMOS inverter: VTC, switching threshold, noise margin, robustness, propagation delay, static and dynamic power dissipation. Static CMOS design: complementary CMOS, Ratioed logic, pass transistor logic.
Dynamic CMOS design: Dynamic logic, domino logic.

**UNIT-II:**

**Introduction to CMOS fabrication process:** Twin tub Process, latch up in CMOS circuits. CMOS circuit physical design process: MOS Layers, Stick diagrams, Euler Path in stick diagram, Design rules, types of design rules, Layout diagrams of Basic CMOS Logic gates.

**UNIT-III:**

**CMOS Subsystem design:** Architectural issues, Carry select adder, carry save adder and Carry Skip adder, Multiplication: array multiplication, Wallace tree multiplication. Multiplexer and D Flip-Flop using Transmission gates.

**UNIT-IV:**

**Design of Basic Memory Cells:** Classifications of Memories, one and three transistor dynamic RAM cells, six transistor Static RAM, static noise margin. Read only memory: Basic ROM architecture, EPROM, EEPROM, NOR and NAND based ROM Memory Design.

**UNIT-V:**

**CMOS testing:** Role of testing, types of testing, functionality tests, manufacturing tests, stuck-at faults, short circuit and open circuit faults, controllability , observability, delay fault testing, level sensitive scan design, Boundary scan architecture.

## Learning Resources:


1. Digital Integrated Circuits: A Design Perspective – Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolić.2nd edition.
2. CMOS Digital Integrated Circuits: Analysis and Design, Sung-Mo (Steve) Kang and Yusuf Leblebici Edition: 4th Edition.
3. CMOS VLSI Design: A Circuits and Systems Perspective – Neil H. E. Weste, David Harris.
4. https://onlinecourses.nptel.ac.in/noc17_cs35.


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Microwave Engineering Lab

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:2 | SEE Marks : 50 | Course Code: **U22PC711EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Understand the basic characteristics of Microwave Vacuum tube sources<br>2. Understand the basic characteristics of Microwave solid state sources<br>3. Verify the characteristics of rectangular wave guide<br>4. Measurement of impedance of various loads at different frequencies<br>5. Understand the measurement of various parameters of microwave components | On completion of the course, students will be able to<br>1. Describe the characteristics of microwave sources<br>2. Estimate the guide wave length and free space wave length<br>3. Measure the VSWR and impedance of unknown load<br>4. Determination of the scattering matrix of microwave Components/Junctions and implement course based projects.<br>5. Demonstrate characteristics of ferrite devices |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | 2 | 3 | 2 | 2 | 1 | | 2 | | 3 | |
| CO2 | 2 | 2 | 2 | | 2 | 2 | | 2 | 2 | 1 | | 2 | | 3 | |
| CO3 | 3 | 3 | | | 2 | 2 | | 2 | 2 | 1 | | 2 | | 3 | |
| CO4 | 3 | 3 | | 3 | 3 | 2 | | 2 | 2 | 3 | 3 | 2 | | 3 | |
| CO5 | 3 | 3 | | | | 2 | | 2 | 2 | 1 | | 2 | | 3 | |

**Experiments:**

1. Characteristics of Reflex Klystron oscillator
2. Characteristics of Gunn diode oscillator
3. Measurement of frequency and Guide wavelength
4. Measurement of VSWR of a given load
5. Measurement of impedance
6. Scattering matrix of a Directional coupler.
7. Scattering matrix of Waveguide Tees: E plane, H plane

8. Scattering matrix of Magic Tee.
9. Characteristics of Isolator and its scattering matrix
10. Characteristics of Circulator and its scattering matrix
11. Calibration of attenuator at a given frequency
12. Calibration of frequency meter at a given frequency

**New / Additional experiments planned:**

1. Gain and Radiation Pattern analysis and measurement of user defined Antenna.
2. Measurement of S-parameters using vector network analyzer.

**Learning Resources:**

1. Advanced Design Software(ADS)

**Guidelines for course based projects:**

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from the faculty members offering the course.
- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

**The break-up of CIE:**

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Marks earmarked for Course-based Project | : | 05 |
| 3. | Marks earmarked for day-to-day lab class assessment | : | 13 |
| 4. | Marks earmarked for lab internal test | : | 12 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# VLSI Design Lab

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:2 | SEE Marks : 50 | Course Code: **U22PC721EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To design and verify CMOS static and dynamic Inverter<br>2. To convert schematic design into layout<br>3. To design and simulate various adders<br>4. To Design and simulate different memories<br>5. To test the given CMOS circuit | On completion of the course, students will be able to<br>1. Demonstrate the knowledge of digital circuit design flow.<br>2. Develop and analyze the process of simulation of combinational circuits.<br>3. Analyze the process of simulation of sequential circuits.<br>4. Evaluate the flow of schematic to layout of combinational and sequential circuits.<br>5. Validate and demonstrate the results of digital circuits. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 2 | | 3 | | | 2 | | | | | 3 | | |
| CO2 | 1 | 3 | | | 2 | | | 2 | | | | | 3 | | |
| CO3 | 1 | 3 | 2 | 3 | 3 | | | 2 | | | | | 3 | | |
| CO4 | 2 | | 2 | | 2 | | | 2 | | | | | 3 | | |
| CO5 | 2 | | 2 | 3 | 2 | | | 2 | | | | | 3 | | |

1. Design and simulate pseudo NMOS Inverter
2. Design and simulate CMOS inverter.
3. Design and simulate two input CMOS NAND/NOR gate.
4. Design and simulate CMOS Full adder
5. Design and simulate the D-Flip Flop.
6. Simulate the dynamic memory 1Transistor and 3 Transistor cells.
7. Simulate the static memory 6 Transistor cell.
8. Layout of CMOS inverter

9. Perform DRC and LVS of CMOS inverter
10. Perform parasitic extraction of CMOS inverter
11. Perform Post layout level simulation of CMOS inverter
12. Perform CMOS circuit testing for stuck at 1 and stuck at 0 faults.

**New / Additional experiments planned:**

1. Design and simulate 4-bit carry select adder.
2. Simulate the static memory 4 transistor SRAM memory cell.

**Note:**

Minimum of twelve experiments are to be conducted.

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Tests | : | 1 |
| 2. | Max. Marks for internal tests | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Project Seminar

SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:3 | SEE Marks : - | Course Code: **U22PW719EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : - |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To guide students in identifying and formulating complex engineering problems through comprehensive literature review and analysis of current societal needs.<br>2. To familiarize students with modern engineering tools and technologies relevant to their chosen area of study or research.<br>3. To develop students skills in designing experiments, analyzing data, and interpreting results with scientific reasoning.<br>4. To enhance students technical communication abilities through structured report writing and oral presentations, while upholding academic and professional ethics.<br>5. To encourage collaborative learning and teamwork, fostering adaptability to emerging technologies and multidisciplinary approaches. | On completion of the course, students will be able<br>1. To select the complex engineering problems beneficial to the society after thorough literature survey<br>2. To identify the modern tools for solving the problems.<br>3. To analyze and comprehend the experimental results<br>4. To communicate effectively the experimental results with report and presentation following ethics<br>5. To work in teams and adapt for the advanced technological changes |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | 2 | | | | | | 3 | | | |
| CO2 | | 2 | | | 3 | | | | | | | 3 | | | |
| CO3 | 2 | 2 | | 3 | | | 3 | | | | | 3 | | | |
| CO4 | | | | | | | | 3 | 2 | 3 | | | | | |
| CO5 | | | | | | | | | 3 | | | 3 | | | |

Note: CO1 & CO2 must be mapped with one of the relevant PSOs based on the domain of the project with 3
CO3: can be mapped to appropriate PSO with level 2

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her specialization.

Project seminar topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of seminar presentation.

- Selection of Topic & Literature Survey (5M)
- Solution & Clarity in Implementation (5M)
- Modern Tool usage & Implementation (5M)
- Results and Analysis (5)
- Team Work / Report writing & Presentation with ethics (10M)

**Each student is required to:**

1. Submit a one-page synopsis in the beginning of the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3rd week of the semester to the last week of the semester and any change in schedule should be discouraged.

Students are required to submit a report on the project seminar.

- Batch size shall be 2 (or) 3 students per batch.
- Two reviews – One during 5th week and another during 10th week and final evaluation shall be conducted during 15th to 16th week.
- Students are required to give Presentations during the reviews.
- Students are required to submit project seminar report.

# B.E (ECE) VII - Semester

# Professional Electives

# (R-22)

# for the Academic Year: 2025 - 2026

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Advanced Embedded Systems

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code : **U22PE710EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Define and classify embedded systems.<br>2. Justify the importance of ARM as CPU and write assembly programs.<br>3. Understand different serial protocols used for embedded networking.<br>4. Compare embedded software architectures.<br>5. Analyze debugging methods. | 1. Define embedded system and describe the embedded system product design life cycle and challenges.<br>2. Describe ARM Core architecture along with its programming model.<br>3. Apply knowledge to design networked embedded systems using serial communication protocols.<br>4. Justify the importance of hardware software co-design and models involved.<br>5. Acquire the knowledge of embedded IDEs to design & specify debugging techniques. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | | 1 | | | | | | | 3 | 3 | 2 | |
| CO2 | 3 | 2 | 3 | | 1 | | | | | | | 3 | 3 | 2 | |
| CO3 | 3 | 2 | 3 | | 1 | | | | | | | 3 | 3 | 2 | |
| CO4 | 3 | 2 | 3 | | 1 | | | | | | | 3 | 3 | 2 | |
| CO5 | 3 | 2 | 3 | | 2 | | | | | | | 3 | 3 | 2 | |

**UNIT – I :**

**Embedded System Design:** Introduction, Trends, Definition, Classifications; Embedded Product Development Life Cycle. CPU selection– hardware, software, memories, and I/O. Challenges in designing Embedded System; Design Metric of Embedded System.

**UNIT - II:**

**ARM Processor Fundamentals:** ARM Cortex-M based microcontroller architecture; ARM ISA, Memory Address Map, ARM Registers, ARM Cortex M4 Core Registers, ARM assembly programs: data transfer and branching

instructions; ARM addressing modes; AMBA System Bus and Bus Matrix, Memory and Peripherals, JTAG Debug System.

**UNIT - III:**

**Embedded Networking:** Embedded Networking design considerations; Embedded Networking through serial protocols: UART, I2C, SPI, CAN, IEEE1394 and USB; Porting of TCP/IP: Socket selection; HTTP client-server model.

**UNIT - IV:**

**Hardware Software Codesign:** Comparison of Co-Design Approaches; Formulation of the HW/SW scheduling, Optimization of Design Metric: Case study of Embedded Adaptive Cruise Control ECU Design.

**Embedded Software Architectures:** Round Robin, RR with interrupt driven, and Functional Queue architectures.

**UNIT - V:**

**Embedded development tools:** Host and Target machines, instruction packing: Endianness: Big-endian and little-endian ISA; application translation process for hardware executable: Intel and Motorola modes.

**Debugging Methods:** Testing on Host–Instruction set Simulators, native tools – IDEs, cross-compilers; ICE, JTAG, laboratory tools: Multi meter, CRO, Logic Analyzer & protocol sniffers.

**Learning Resource:**


1 Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, and Shujen Chen. 2016. "ARM Assembly Language Programming & Architecture (Volume 1)"

2 Raj Kamal. "Embedded Systems" 4th Edition 2020, McGraw Hill Education (India) Private Limited.

3 Wayne Wolf. 2008. Computers as Components, Second Edition: Principles of Embedded Computing System Design (2nd. ed.). Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.

4 https://onlinecourses.nptel.ac.in/noc20_cs15/preview


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Advanced Embedded Systems Lab

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:2 | SEE Marks : 50 | Course Code: **U22PE711EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Write ARM assembly programs.<br>2. Implement Cortex M4Fxx embedded C programs.<br>3. Configure GPIOs of STM32F4xx for interfacing I/O devices<br>4. Use cross compiler tools for writing C or ARM ASM drivers.<br>5. Demonstrate a course-based project using STM32F4 MCU. | On completion of the course, students will be able to<br>1. Implement ARM assembly data processing instructions for Cortex M4.<br>2. Construct programs & Validate designs using cross assembler & compiler.<br>3. Develop embedded C drivers for on-chip peripherals of STM32F411RE.<br>4. Design system level solutions with off-chip components in Proteus<br>5. Implement a working prototype as a course based project. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 3 | | 3 | | | | | | | 3 | 3 | 2 | 1 |
| CO2 | 1 | 2 | 3 | | 3 | | | | | | | 3 | 3 | 2 | 1 |
| CO3 | 1 | 2 | 3 | | 3 | | | 2 | | | | 3 | 3 | 2 | 1 |
| CO4 | 1 | 2 | 3 | | 3 | | | 2 | 3 | | | 3 | 3 | 2 | 1 |
| CO5 | 1 | 2 | 3 | | 3 | | | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |

## Cycle – 1

1. Assembly language programs to perform arithmetic operations
2. ARM assembly to do different logical operations; CPSR flags.
3. Load & Store instructions: LDR, LDRH, LDRB, STR, STRH, STRB
4. ARM Addressing: Immediate, register & register indirect modes
5. Branching instructions of ARM: BCS, BCC, BNE, BLS, BHI
6. Unconditional Call instructions for ARM: B, BL, BX

**Cycle – 2**

7. GPIO programming in embedded C for STM32F's CortexM4MCU
8. Seven segment LED display interfacing with STM32F MCU
9. Interfacing a switch to STM32F and controlling the LED
10. Interfacing LCD (2x16) and development of driver for ARM
11. Keypad interface driver implementation in embedded C
12. Integration of LCD and Keypad for User Interface options in C

**New Experiments:**

1. I/O port programming with CortexM4 ARM Assembly
2. Calling C functions from ARM Assembly and Vice Versa

| | | | |
|---|---|---|---|
| **Cross Compiler** | Keil µVision5 IDE | **Targets** | STM32F401RE (Simulation)<br>STM32F411RE (Board);<br>STM32F446RE (Board) |
| **Simulation Software** | Proteus 8.12 IDE | **Debugger** | JTAG SWI STM32 |

**Guidelines for course based projects:**

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from the faculty members offering the course.
- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

**The break-up of CIE:**

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Marks earmarked for Course-based Project | : | 05 |
| 3. | Marks earmarked for day-to-day lab class assessment | : | 13 |
| 4. | Marks earmarked for lab internal test | : | 12 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Software Defined Radio and its Applications

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs/Week): 3:0:0 | SEE Marks: 60 | Course Code: **U22PE720EC** |
| Credits: 3 | CIE Marks: 40 | Duration of SEE: 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| The course aims to<br>1. Provide students with a comprehensive understanding of Software Defined Radio (SDR) principles and technologies.<br>2. Explore RTL-SDR for practical applications.<br>3. Implement custom SDR solutions<br>4. Delve into Pluto SDR for wireless communication implementations<br>5. Master USRP platforms for advanced SDR applications | On completion of the course, students will be able to<br>1. Analyze GNU Radio for various signal processing, and communication applications.<br>2. Develop the skills to set up, configure, and operate RTL-SDR devices for practical applications.<br>3. Implementing signal processing algorithms and communication techniques using Pluto SDR and GNU Radio.<br>4. Configure and interface with USRP devices using GNU Radio<br>5. Design and implement custom communication systems, and apply advanced signal processing techniques for SDR applications |

**CO-PO-PSO Mapping:**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | 3 | 3 |
| CO2 | 3 | 3 | 3 | | 3 | | | | | | | | | 3 | 3 |
| CO3 | 3 | 3 | 3 | | 3 | | 3 | | | | | | | 3 | 3 |
| CO4 | 3 | 3 | 3 | | 3 | | | | | | | | | 3 | 3 |
| CO5 | 3 | 3 | 3 | | 3 | | | | | | | 3 | | 3 | 3 |

**UNIT-I: Introduction to GNU Radio**

Introduction to GNU Radio, Role of GNU Radio in SDR applications, Introduction to GNU Radio Toolkit, GNU Radio Architecture and Components, GNU Radio Companion (GRC): Basics and Workflow
Signal Processing Blocks in GNU Radio, Communication blocks in GNU Radio

**UNIT-II: RTL-SDR**

Software Defined Radio (SDR) concepts: benefits, limitations, block diagrams,

Introduction to RTL-SDR hardware, Installation and setup of RTL-SDR software. Basic signal reception using RTL-SDR, Signal Reception Techniques with RTL-SDR, Spectrum Analysis using RTL-SDR

**UNIT-III: Pluto SDR**

Hardware Overview and Specifications, Setting up Pluto SDR Environment (Drivers, Firmware)

Pluto SDR Applications and Use Cases, Signal Processing with Pluto SDR, Configuring Pluto SDR with GNU Radio

**UNIT-IV: USRP**

USRP Hardware Overview and Specifications, Installing and Configuring USRP Drivers and Software

Advanced Signal Processing Techniques with USRP, Designing Custom Communication Systems with USRP, Setting up USRP with GNU Radio

**UNIT-V:**

Advanced Signal Processing Techniques in GNU Radio, Real-world SDR applications and case studies,

Digital Modulation Schemes and Demodulation Techniques, Spectrum Monitoring, Cognitive Radio

Design and Implementation of SDR Application

## Learning Resources:


1. Travis F. Collins, Robin Getz, Di Pu, Alexander M. Wyglinski, "Software-Defined Radio for Engineers" Analog Devices perpetual eBook license – Artech House copyrighted material. 2018 ISBN-13: 978-1-63081-457-1
2. Marcus D. Leech. "Software Defined Radio using GNU Radio". CreateSpace Independent Publishing Platform, 2015.
3. GNU Radio Companion: The Software Defined Radio Cookbook by Andreas Jahn, Benjamin M. Klein (2010)
4. Hacking RF: Learn How to Build Software Defined Radios by Nickolas Palazzo (2016)


The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Software Defined Radio and its Applications Lab

(Professional Elective-I)
SYLLABUS FOR B.E. VII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:2 | SEE Marks : 50 | Course Code: **U22PE721EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Equip students with the practical experience to excel in the field of SDR using GNU Radio.<br>2. Understanding the radio-in-the-loop development workflow. Using USRPs as radio-in-the-loop development platforms.<br>3. Give hands on experience to work with Pluto SDR, RTL SDR with GNU radio.<br>4. Implement signal processing for higher order modulations using GNU radio<br>5. Model frequency offset, timing jitter errors, and mitigation using frequency and timing synchronization techniques | On completion of the course, students will be able to<br>1 Design and implement SDR applications using GNU Radio Companion (GRC).<br>2 Configure RTL-SDR devices, capture radio signals, and perform spectrum analysis using GNU Radio<br>3 Implementing wireless communication and signal processing applications using Pluto SDR<br>4 Implementing signal processing algorithms, and performing real-time spectrum analysis using USRP.<br>5 Analyze and mitigate frequency offset and timing jitter errors in Software Defined Radio (SDR) systems using appropriate frequency and timing synchronization techniques. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | 3 | | | 2 | | | | | | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | | | 2 | | | | | | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | | | 2 | | | | | | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | | 3 | 2 | | | | | | 3 | 3 |
| CO5 | 3 | 3 | | 2 | 3 | 2 | | 2 | | | | 3 | | 3 | 3 |

## Experiments:

1. Generating and Visualizing Signals using GNU Radio
2. Implement an amplitude modulation (AM) transmitter and receiver using GNU Radio blocks.
3. BPSK (Binary Phase Shift Keying) Modulation and Demodulation using GNU Radio blocks.

4. QPSK (Quadrature Phase Shift Keying) Modulation and Demodulation using GNU Radio blocks.
5. Design of Digital filter for removing of noise
6. Design of Signal Recording and Playback
7. Receiving and Demodulating FM Radio Signals using RTL SDR
8. Exploring the Radio Spectrum using RTL SDR
9. Design of FM transmitter and using Pluto SDR
10. Experiment with different modulation schemes and observe the impact on communication performance using Pluto SDR
11. Implement a frequency-shift keying (FSK) transmitter and receiver using USRP.
12. Experiment with different modulation schemes and observe the impact on communication performance using USRP

**New / Additional experiments planned:**

1. Implement a simple OFDM transmitter by dividing the data stream into subcarriers using a Packet Packer block.
2. Implement a DTMF decoder in GNU Radio to identify the dialled digits based on the received frequencies.
3. Software Defined Radio (SDR) for GSM Signal Analysis using Pluto SDR.
4. Implement a real-time spectrum analyzer using USRP and GNU Radio for spectrum monitoring applications.

**Mini Project(s):**

Capture LoRa packets used in various IoT applications.

**Learning Resources:**

1. GNU radio

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Tests | : | 1 |
| 2. | Max. Marks for internal tests | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Artificial Neural Networks

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week): 3:0:0 | SEE Marks : 60 | Course Code: **U22PE730EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Develop a solid foundation in Neural Networks<br>2. Provide technical details on Activation and Pattern recognition<br>3. Emphasize concepts on Feed Forward Neural Networks<br>4. Cover Feedback Neural Networks<br>5. Train with real-world applications | On completion of the course, students will be able to<br>1. Interpret basics of Neural Networks.<br>2. Apply activation functions.<br>3. Apply Feed forward neural networks.<br>4. Apply Feedback Neural Networks.<br>5. Design Neural Network Models for various applications. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | | 3 |
| CO2 | 2 | 3 | | | | | | | | | | | | | 3 |
| CO3 | 3 | 3 | 2 | | | | | | | | | | | | 3 |
| CO4 | 2 | 3 | 2 | | | | | | | | | | | | 3 |
| CO5 | 3 | 3 | 3 | | | 2 | | | | | | 3 | | | 3 |

**UNIT-I**

Basics of Neural Networks: Characteristics of Neural Networks, Artificial Neural Networks Terminology, Models of Neuron, Topology, Basic Learning Laws

**UNIT-II**

Activation and Synaptic Dynamics: Introduction, Activation Dynamics Models, Synaptic Dynamics Models, Learning Methods.
Pattern Recognition: Pattern Recognition Problem, Basic Functional Units

**UNIT-III**

Feedforward Neural Network: Introduction, Analysis of Pattern Association Networks, Analysis of Pattern Classification Networks

**UNIT-IV**

Feedback Neural Networks: Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks.
Recurrent Neural Networks: Introduction, Architecture of RNN,
Convolutional Neural Networks: Introduction, Basic Structure of Convolutional Network.

**UNIT-V**

Applications of ANN: Neural networks for binary and multi classification tasks, neural networks for regression tasks, Handwritten digit recognition using Neural Network

## Learning Resources:


1. B. Yegnanarayana - Artificial neural network, PHI Publication.2012.
2. Charu C. Aggarwal-Neural Networks and Deep Learning, Springer 2018.
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005.
4. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press, 1995.
5. https://nptel.ac.in/courses/117105084


The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Artificial Neural Networks Lab

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week): 0:0:2 | SEE Marks : 50 | Course Code: **U22PE731EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Cover practical implementation of Neuron concepts<br>2. Expose on Perceptron Learning and Hop field networks<br>3. Hands on exposure on Feed forward Neural Networks<br>4. Provide insights on classification and regression<br>5. Train in real time applications | On completion of the course, students will be able to<br>1. Implement fundamental Neuron concept.<br>2. Apply Perceptron Learning Techniques.<br>3. Implement Hopfield Neural Network.<br>4. Design and implement Neural Networks for classification and regression tasks.<br>5. Design and implement Neural Networks for real time applications |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 3 | | | 2 | | 2 | | | | | 3 |
| CO2 | 3 | 3 | 2 | | 3 | | | 2 | | 2 | | | | | 3 |
| CO3 | 3 | 3 | 2 | | 3 | | | 2 | | 2 | | | | | 3 |
| CO4 | 2 | 3 | 3 | 2 | 3 | | | 2 | | 2 | | 3 | | | 3 |
| CO5 | 2 | 3 | 3 | 2 | 3 | 2 | | 2 | | 2 | | 3 | | | 3 |

## List of Experiments

### Cycle-I

1. Weight and Bias effect on Neuron
2. Activation function effect on Neuron
3. Perceptron Learning rule for computing new weights
4. Perceptron Learning by changing number of epochs
5. Hopfield Neural Network
6. Generate Feedforward Neural Network

**Cycle-II**

1. Feedforward Neural Network with gradient descent and variable learning rate gradient descent.
2. Neural Network for Binary Classification
3. Neural Network for Multi Classification
4. Neural Network for Regression problem
5. Handwritten digit recognition using Neural Network
6. Image classification using Convolutional Neural Network

**New/ Additional experiments planned:**

1. Machine Learning using Neural Networks
2. Deep Learning using Neural Networks

**Learning Resources/Tools**

1. MATLAB 2023a.
2. B. Yegnanarayana - Artificial neural network PHI Publication.2012.
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005
4. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Max. Marks for internal test | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Voice and Data Networks

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE740EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To understand fundamental network design principles, performance issues, and terminology associated with voice and data communication.<br>2. To explore network architectures including layered models, cross-layer designs, and switching mechanisms in voice and data networks.<br>3. To analyze the role of data and control planes in the network layer and examine routing protocols and SDN fundamentals.<br>4. To apply queuing and traffic models for analyzing network performance, and understand medium access control in local area networks.<br>5. To provide a comprehensive understanding of VoIP systems, including their architecture, protocols, echo management, performance metrics, and Quality of Service (QoS) techniques. | On completion of the course, students will be able to<br>1 Identify and describe key network design and performance issues relevant to centralized and distributed systems.<br>2 Apply switching techniques and layered architectures used in wired and wireless voice/data communication.<br>3 Demonstrate the ability to configure routing protocols and explain the fundamentals of software-defined networking.<br>4 Apply queuing theory and Markov models to evaluate the performance of traffic in various network scenarios.<br>5 Analyze and evaluate VoIP technologies and protocols, and apply QoS mechanisms to ensure efficient and reliable voice communication over IP networks. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO2 | 3 | 3 | 3 | | | | | | | | | | | 3 | |
| CO3 | 3 | 3 | 3 | | | | | | | | | | | 3 | |
| CO4 | 2 | 3 | | | | | | | | | | | | 3 | 3 |
| CO5 | 3 | 3 | | | | 2 | | | | | | 2 | | 3 | 3 |

## UNIT – I

Network requirements, Network Performance parameters, Network Terminology, Voice and data networks, Issues in design of voice and data networks. Network architecture, Network software.

**UNIT – II**

Switching, Three Stage Space Division Switch, Blocking and Non-blocking switching, Introduction to Signaling System Number 7 (SS7), Circuit Switching and Packet Switching, Multiplexing.

**UNIT – III**

Network layer-date plane: Input and output processing, input and output queuing, packet scheduling. Control plane: Routing in Internet. OSPF, BGP,RIP,NAT, Software defined networking (SDN) fundamentals

**UNIT – IV**

Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1 and other Markov systems, Examples of LAN, Types of VLAN, Trunking, Advantages.

**UNIT-V**

Introduction to VOIP, VOIP architecture and components, VOIP protocols-SIP,H.23,RTP,RTCP, Echo cancellation, metrics: latency, jitter, packet loss, QoS techniques: DiffServ, IntServ, RSVP, security in VOIP

**Learning Resources:**


1. J. F. Kurose and K. W. Ross, Computer Networking: A Top-Down Approach, 8th ed., Boston, MA, USA: Pearson, 2020.
2. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
3. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufman, 2011.
4. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.
5. Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
6. Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.
7. https://nptel.ac.in/courses/106105082
8. "Understanding Voice over IP Technology "Author: Nicholas Wittenberg Publisher: Delmar Cengage Learning


The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Voice and Data Networks Lab

(Professional Elective-I)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:2 | SEE Marks : 50 | Course Code: **U22PE741EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce the functions and roles of Layer 2 and Layer 3 devices in data communication networks.<br>2. To provide hands-on experience in configuring and troubleshooting fundamental network protocols such as RIP, DHCP, and NAT.<br>3. To familiarize students with wireless security mechanisms and enable configuration of basic wireless network protection schemes like WEP.<br>4. To develop an understanding of voice communication technologies and protocols including VoIP and SIP through MATLAB simulations.<br>5. To enable learners to analyze and implement network segmentation using VLANs and compare routing strategies for network efficiency. | On completion of the course, students will be able to<br>1. Demonstrate understanding of Layer 2 and Layer 3 devices and their roles in network architecture.<br>2. Configure and troubleshoot basic networking protocols such as RIP, DHCP, NAT<br>3. Illustrate secure wireless networking practices through configuration of WEP and observation of wireless behavior.<br>4. Apply the voice communication concepts.<br>5. To analyze network segmentation using VLAN concepts and evaluate the effectiveness of static and dynamic routing. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 2 | | | 2 | | | | | | 3 | |
| CO2 | 3 | 2 | | | 2 | | | 2 | | | | | | 3 | |
| CO3 | 3 | 2 | | | 2 | | | 2 | | | | 2 | | 3 | |
| CO4 | 2 | 2 | 3 | | 2 | | | 2 | | | | | | 3 | |
| CO5 | 3 | 2 | | 3 | 2 | | | 2 | | | | 2 | | 3 | 3 |

**LIST OF EXPERIMENTS:**

## Cycle-I

1 Interpreting Layer 2 and Layer 3 devices

2 Demonstrating Distribution Layer Functions

3 Configuring routing information protocol.

4 Configuring WEP on a Wireless Router

5 Exploring Different layer 2 devices Options

6 Implementing classless inter domain routing.

**Cycle-II**

7 Examining Network Address Translation

8 Observing Static and Dynamic Routing

9 Configuring a Cisco Router as a DHCP Server

10 Implement VOIP using MATLAB

11 Implement SIP using MATLAB

12 Implement VLAN in MATLAB

**Additional Experiments**

1 Voice quality analysis (using MATLAB or Wireshark)

2 Implement RTP, RTCP protocols

**List of Equipment :**

Software: Packet tracer & MATLAB

Equivalent Hardware: Standalone desktops

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Max. Marks for internal test | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# IoT Architectures and Protocols

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE750EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce the fundamentals of IoT, including its evolution, characteristics, physical and logical design, and enabling technologies.<br>2. To understand IoT reference architectures, deployment views, edge system design, and real-world design constraints.<br>3. To explore IoT communication protocols across physical, network, transport, and application layers.<br>4. To study real-world IoT applications through case studies in smart systems and analyze IoT adoption in the Indian context and Industry 4.0.<br>5. To identify and address security requirements and threats in IoT systems, covering architecture, protocols, and device-level protections. | On completion of the course, students will be able to<br>1. Understand the Architectural Overview of IoT<br>2. Enumerate the need and the challenges in Real World Design Constraints<br>3. Choose the required protocol for a given application.<br>4. Explore IoT usage in various applications<br>5. Understand the Security requirements in IoT. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | 1 | 1 |
| CO2 | 3 | 2 | 3 | | | | 2 | | | | | 2 | 1 | 2 | 2 |
| CO3 | 3 | 1 | | | | | | | | | | | | 1 | 1 |
| CO4 | 3 | 1 | | 1 | | 2 | 2 | | 2 | | | 2 | | 2 | 2 |
| CO5 | 3 | 2 | | 1 | | 2 | | | | | | 2 | | 1 | 1 |

**UNIT - I : IoT**

Definition and Technologies that led to evolution of IOT, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment. M2M and IoT Technology Fundamentals- Devices and gateways, Introduction to cloud IOT platforms like MS Azure, AWS IOT, Google Cloud IOT, Thingworx, Business processes in IoT.

**UNIT - II : IoT Reference Architecture**

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. IoT edge system architecture.

**Real-World Design Constraints:** Technical Design constraints, Connectivity constraints, Data representation and visualization, Big Data Management.

**UNIT - III : IoT communications**

**Data link and physical layer Protocols**: PHY/MAC Layer (IEEE 802.11,

IEEE 802.15), Bluetooth Low Energy, Thread, introduction to Wi-SUN.
**Network Layer Protocols:** IPv6, 6LoWPAN;
**Transport layer protocols:** TCP, UDP;
**Messaging protocols:** Quality of services in MQTT, standards and security in MQTT, CoAP, AMQP.

**UNIT - IV : Case Studies**

Smart Cities, Smart Homes, Smart Transportation, Smart Healthcare, Precision Agriculture, Connected Vehicles.
**IOT in Indian Scenario:** i) IOT and Aadhaar ii) IOT for health services. iii) IOT for financial inclusion. iv) IOT for rural empowerment v) India Urban Data Exchange (IUDX).
**Industry 4.0**: Industrial Internet of Things (IIoT), Reference Architecture, Characteristics of Industry 4.0.

**UNIT - V : Securing the Internet of Things**

Security Requirements in IoT Architecture - Security in Enabling Technologies, Security Concerns in IoT Applications.
Security Architecture in the Internet of Things - Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, and Availability, Attacks Specific to IoT. Security and Vulnerabilities – Secrecy & Secret Key Capacity, Authentication/Authorization for Smart Devices, Transport Encryption, Secure Cloud/Web Interface, Secure Software/Firmware, Physical Layer Security.

**Learning Resources:**


1 Pethuru Raj and Anupama C. Raman, —The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st Edition, 2017, CRC Press.
2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henny "IoT Fundamentals: Networking technologies Protocols, and Use Cases for the internet of things", June, 2017, Cisco press.
3 Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, —From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, 2014, Academic Press.
4 Arshdeep Bahga, Vijay Madisetti, —Internet of Things: A Hands-on Approach‖, Universities Press, 2014.
5 Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren, Packt Publishing, 2016.
6 Securing the Internet of Things Elsevier Authors: Shancang Li Li Da Xu, Paperback ISBN: 9780128044582,Imprint: Syngress Published Date: 13th January 2017.
7 https://nptel.ac.in/courses/106105166/5
8 https://nptel.ac.in/courses/108108098/4


The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# IoT Architectures and Protocols Lab

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week): :0:0:2 | SEE Marks : 50 | Course Code: **U22PE751EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce the SiWx917 development kit, WiSeConnect SDK, and Simplicity Studio for IoT application development.<br>2. To enable students to analyze Wi-Fi connectivity and power-saving mechanisms in IoT devices using tools like Wireshark and Energy Profiler.<br>3. To familiarize students with the implementation of SiWx917 as an access point and an embedded MQTT client.<br>4. To provide hands-on experience in developing IoT use cases, including people-counting applications and Bluetooth-enabled door locks.<br>5. To guide students in designing energy-efficient smart street lighting solutions using Wi-SUN mesh and Silicon Laboratories development kits. | On completion of the course, students will be able to<br>1. Apply knowledge in writing the programs using Simplicity Studio.<br>2. Implementing the power saving mechanisms in Wi-Fi.<br>3. Apply knowledge in making Silicon lab boards as access point and MQTT client.<br>4. Choose suitable protocol for a specified application.<br>5. Develop real world applications using Silicon lab boards. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | 3 | | | 2 | | | | | 1 | | |
| CO2 | 2 | 2 | 1 | | 3 | | 3 | 2 | 2 | | | | 1 | 3 | |
| CO3 | 2 | 2 | 1 | | 3 | | | 2 | 2 | | | | 3 | 1 | |
| CO4 | 2 | 2 | 1 | 1 | 1 | | | 2 | | | | | 1 | 3 | |
| CO5 | 3 | 3 | 2 | 1 | 3 | | | 2 | 2 | | 3 | 3 | 3 | 1 | |

## Cycle-1

1. Introduction to SiWx917, WiSeConnect SDK (Software Development Kit) and Simplicity Studio.
2. Basic Wi-Fi connection with SiWx917 (With Wireshark Analysis).
3. Demonstration of power save mechanisms in Wi-Fi with SiWx917 (Demo with Energy Profiler).

4. SiWx917 as an access point.
5. SiWx917 as an Embedded MQTT Client
6. Target wake Time with SiWx917

**Cycle-2**

**Any Two use cases**

7. **People-counting application** using Silicon Laboratories development kits and a VL53L1X distance sensor.
   a. Application initialization
   b. Sensor initialization
   c. Sensor Sampling
   d. Implementation of People counting algorithm

8. **Bluetooth door lock application** using Silicon Laboratories development kits, SparkFun Micro OLED Breakout (Qwiic) board, Cap Touch 2 Click MikroE board, and BUZZ 2 click Mikroe board.
   a. Application initialization
   b. Using EFR Connect Mobile Application
   c. Locking the Door
   d. Unlock the Door
   e. Change the door unlock password and the passkey.
   f. Securing BLE Designs

9. **Smart street lighting solution** with Wi-SUN mesh using Silicon Laboratories development Kit.
   a. Adjustable lighting strategies that save energy through on/off switching
   b. Light-level management
   c. Integration with other systems to bring condition-based lighting.

**Software Tools:** WiSeConnect SDK (Software Development Kit), Simplicity Studio and Wire Shark.
**Hardware:** SiWx917 Development Kit, VL53L1X distance sensor, BUZZ 2 click Mikroe board and EFR32FG25 Wi-SUN Pro Kit.

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Max. Marks for internal test | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Wireless Communications

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE760EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 To introduce the fundamental concepts of wireless communication systems<br>2 To analyze radio wave propagation and channel modelling.<br>3 To understand cellular system design concept.<br>4 To explore the architecture and functioning of modern wireless systems.<br>5 To analyze and evaluate the performance of wireless systems under various channel conditions | On completion of the course, students will be able to<br>1 Summarize the progression of from 1G to 5G and analyse the 2G systems.<br>2 Apply mobile radio wave propagation models to evaluate channel characteristics.<br>3 Analyze 3G communication technologies and evaluate Bit Error Rate performance for various wireless system configurations.<br>4 Analyse 4G systems using OFDM, MIMO techniques and Massive MIMO and beamforming in 5G networks.<br>5 Model wireless communication system and Implement course based project |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 3 | | | | | | | | | | 3 | |
| CO2 | 2 | 3 | | 3 | | | 3 | | | | | | | 3 | 3 |
| CO3 | 3 | 3 | | 2 | | | | | | | | | | 3 | |
| CO4 | 2 | 2 | | 3 | | | | | | | | 3 | | 3 | 3 |
| CO5 | 2 | 2 | 2 | 2 | 3 | 3 | | 3 | 3 | 3 | 3 | | | 3 | |

## UNIT - I : Introduction to wireless communication

Evolution of Wireless Communication Systems: A Brief History from 1G to 5G, classification of wireless communication systems

**2G systems:**

Fundamental architecture of cellular system, its operation, frequency reuse, channel assignment strategies, Handoff process, GSM architecture, GSM Channels, Channel access mechanisms (FDD, TDD),

**UNIT - II: Mobile Radio Wave propagation**

Large scale propagation models- Free space propagation model, three basic propagation mechanisms, practical link budget design using path loss models, Impulse response of the wireless channel, small scale fading and multipath propagation, Mathematical modelling of fading channel coefficient, Parameters of mobile multipath channels, types of small-scale fading.

**UNIT - III:3G systems**

3G Technologies Overview, 3G Network Architecture, 3G Data services-3G W-CDMA(UMTS), 3G CDMA, 3G TD-SCDMA

**Multi antenna systems: BER Analysis**

BER analysis of wired communication system, SISO wireless system, Diversity, BER analysis of multiple antenna system: Maximal ratio combining, Diversity order, BER analysis of MISO wireless system

**UNIT - IV: 4G systems**

Introduction to OFDM, Multicarrier transmission, cyclic prefix in OFDM, Schematic representation of OFDM transmitter and receiver, BER analysis of OFDM system, LTE

Introduction to MIMO wireless communication systems, MIMO system model, MIMO ZF receiver, MIMO MMSE receiver

**UNIT-V: 5G systems**

5G Network Architecture, 5G Radio Access Technologies, Massive MIMO and Beamforming

**Learning Resources:**

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010
2. Aditya K. Jagannatham, "Principles of Modern Wireless Communication Systems Theory and Practice", McGraw Hill Education (India) Private Limited, 2017.
3. Principles of modern CDMA/MIMO/OFDM Wireless Communications – by Prof. Aditya. K. Jagannatham, IIT Kanpur. (NPTEL Course)
4. Introduction to cellular and wireless communications - by Dr. David. Koil pillai, IITM. https://nptel.ac.in/courses/106106167/
5. https://www.coursera.org/learn/wireless-communications
6. https://www.udemy.com/introduction-to-wireless-communications

**Guidelines for course based projects:**

- Batch size shall be 3 to 4 students per batch.
- Project topics may be chosen by the student with advice and approval from

the faculty members offering the course.

- Students have to submit a one-page abstract in the beginning of project work
- Output of the course based project should be demonstrable / measurable / outcome based.
- Finalization of the project topics, batches formation and project review schedule should be completed by the end of week-2. Project work will be carried out by the students from week-3 onwards.
- One review will be conducted for evaluating the project from week-10 to week-13 as per the schedules announced.
- Students will give a 20 minutes presentation through power point presentation followed by a 10 minutes discussion.
- Students are required to submit project report.

**Assessment and Evaluation of Course Based Project:**

The total marks should be a maximum of five (05) earmarked for Course-based project. The marks secured by the students in the respective Course-based project should be considered in lieu of one assignment i.e., for five marks. However, the total marks towards assignment marks for that course should be the average of marks secured in the other two assignments and marks secured in the Course-based project.

The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 2 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Wireless Communications Lab

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week): 0:0:2 | SEE Marks : 50 | Course Code: **U22PE761EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To enable students to model and simulate wireless communication systems and channel characteristics<br>2. To impart practical skills in analyzing system performance parameters under varying wireless conditions.<br>3. To demonstrate equalization and noise mitigation techniques for improving communication reliability.<br>4. To introduce students to software tools such as GNU Radio and SystemVue<br>5. To provide hands-on experience with advanced wireless technologies using SDR and 5G simulation environments. | On completion of the course, students will be able to<br>1. Modeling of Wireless communication channel using MATLAB, Simulink.<br>2. Implement Wireless channel equalizers.<br>3. Testing and verification of channel parameters like SNR, BER using ATLA and 5G tool box<br>4. Establishing wireless connection using SDR<br>5. Demonstrating the effects of various types of noise on quality of reception |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | | | 3 | | | 2 | 1 | 2 | | | | 3 | |
| CO2 | 2 | 3 | | | 3 | | | 2 | 1 | 2 | | | | 3 | |
| CO3 | 3 | 3 | | | 2 | | | 2 | 2 | 3 | | | | 3 | |
| CO4 | 2 | 2 | | | 2 | 2 | | 2 | 2 | 2 | | | | 3 | |
| CO5 | 2 | 1 | | 2 | 3 | | | 2 | 2 | 3 | | | | 3 | |

## List of Experiments:

**Cycle -1**

1 Modelling and analysis of a Cellular Layout with Frequency Reuse Patterns in MATLAB
2 Modelling of two ray channel wireless communication systems using MATLAB
3 Modelling and simulation of Multipath fading channel using MATLAB

4 Analyse a wireless channel and evaluate the performance measurements such as BER, throughput, capacity, EVM using MATLAB
5 Wireless Channel equalization: Zero-Forcing Equalizer (ZFE), MMSE Equalizer (MMSEE) using MATLAB
6 Analysing the effects of phase noise, channel noise in higher order modulation using GNU radio.

**Cycle -2**

7 Wireless Path loss Computations - Study of Propagation Path loss Models: Indoor & Outdoor (Using MATLAB Programming)
8 Introduction to SystemVue – OFDM modulation and Demodulation
9 Noise Scaling for Frequency-Domain Channel Modelling and time domain channel modelling using 5G tool box
10 SNR Verification for Frequency-Domain Channel Modelling and time domain channel modelling using 5G tool box
11 Implementation of baseband modulation using System Vue
12 Implementation of RF simulation using System Vue

**General Note:**

1. At least 5 experiments from each part.
2. A total of not less than 10 experiments must be carried out during the semester.

**New / Additional experiments planned:**

1 Establishing wireless communication with 2X2 MIMO using SDR
2 Model 5G NR Communication Links using 5G tool box

## Learning Resources / Tools:

1. Communication Systems Modeling and Simulation Using MATLAB and Simulink, K C Raveendranathan, Government Engineering College, Universities Press (India) Private Ltd, 2011. ISBN: 978-81-7371-722-2; Language: English.
2. Software-Defined Radio for Engineers By Alexander M. Wyglinski, Travis F. Collins, Robin Getz, Di Pu · 2018
3. Digital Communication Systems Using SystemVue (DaVinci Engineering) Hardcover

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Max. Marks for internal test | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Digital Image and Video Processing

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE770EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Develop a solid foundation in Image Processing<br>2. Covering various Transform Techniques<br>3. Emphasize concepts on Spatial and frequency domains<br>4. Provide deep understanding on Compression and Segmentation<br>5. Train on Image and video processing with real-world applications | On completion of the course, students will be able to<br>1 Describe the basic concepts of Image and Video Processing<br>2 Apply the equations to transform images into different domains.<br>3 Apply spatial and transform domain techniques to process images.<br>4 Analyze quality of processed images using appropriate metrics<br>5 Design and implement various image and video processing techniques in a range of real-world applications. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | | 2 |
| CO2 | 2 | 3 | | | 2 | | | | | | | | | | 3 |
| CO3 | 2 | 3 | | | 2 | | | | | | | | | | 3 |
| CO4 | 2 | 3 | | 2 | 2 | | | | | | | | | | 3 |
| CO5 | 2 | 3 | 3 | 3 | 2 | 2 | | | | | | 3 | | | 3 |

**UNIT - I:**

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighbourhood, adjacency, connectivity, distance measures.

**UNIT - II:**

Fourier transform, FFT, Discrete cosine transform, Hadamard transform, Slant transform and their properties.
Wavelet Transforms: Discrete Wavelet Transforms.

**UNIT - III:**

Spatial enhancement techniques: Basic Intensity Transformation functions, Histogram equalization, Histogram specification, Spatial Filtering Techniques.

Frequency domain techniques: Low pass, High pass and Homomorphic Filtering.

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter.

Quality assessment of enhanced images.

**UNIT - IV:**

Image Compression-Redundancy–inter-pixel and psycho-visual, Huffman Coding, Arithmetic coding, Lossless compression – predictive, Lossy compression-predictive and Transform coding techniques (JPEG and JPEG2000).

Image Segmentation - Point, Line and Edge Detection, thresholding - global, region-based segmentation.

Quality assessment of compressed / restored and segmented images.

**UNIT - V:**

Video formation, perception, and representation, two-dimensional motion estimation.

Fingerprint image enhancement, Compression of Satellite images using JPEG, Medical image segmentation, Object tracking in videos.

**Learning Resources:**


1 R.C. Gonzalez and R.E. Woods, Digital Image Processing, 4th Edition, Pearson, 2018.
2 Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004.
3 Video Processing and Communications Yao Wang, Jorn stermann, and Ya-Qin Zhang Prentice Hall, 2002 (Published September 2001).
4 Murat Tekalp, Digital Video Processing" Prentice Hall, 2nd edition 2015.
5 https://nptel.ac.in/courses/117/105/117105135/
6 https://nptel.ac.in/courses/117/105/117105079/


The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Digital Image and Video Processing Lab

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week): 0:0:2 | SEE Marks : 50 | Course Code: **U22PE771EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Covering practical operations on images and videos<br>2. Expose on Transform Techniques on images and videos<br>3. Hands on exposure on segmentation<br>4. Provide insights to implement compression<br>5. Train on video processing | On completion of the course, students will be able to<br>1. Implement basic operations on Images and Videos.<br>2. Apply various transform techniques on images.<br>3. Implement Segmentation technique on images.<br>4. Design and implement compression methods on images.<br>5. Detect moving objects in videos. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 3 | | | 2 | | 2 | | | | | 3 |
| CO2 | 3 | 2 | | | 3 | | | 2 | | 2 | | | | | 3 |
| CO3 | 3 | 2 | | | 3 | | | 2 | | 2 | | | | | 3 |
| CO4 | 3 | 2 | 3 | | 3 | 2 | | 2 | | 2 | | 3 | | | 3 |
| CO5 | 3 | 2 | | 2 | 3 | 2 | | 2 | | 2 | | 3 | | | 3 |

## List of Experiments

## (Conduct any Twelve experiments from given list)

## Cycle-I

1. Reading images
2. Reading videos
3. Pixel based operations
4. Application of DCT on Images
5. Application of HT on Images
6. Application of DWT on Images

**Cycle-II**

7. Image enhancement using spatial domain technique
8. Image enhancement using transform domain technique
9. Lossless Image Compression
10. Image Compression using JPEG
11. Image Segmentation using region growing
12. Object Detection in Video Signal

**New/ Additional experiments planned:**

1. Medical Image segmentation
2. Satellite Image Compression

**Learning Resources/Tools**

1. MATLAB 2023a.
2. R.C. Gonzalez ,R.E. Woods and Steven L Eddins, Digital Image Processing using MATLAB, third Edition, Gatesmark Publishing, 2020.
3. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
4. Video Processing and Communications Yao Wang, Jorn stermann, and Ya-Qin Zhang Prentice Hall, 2002 (Published September 2001).

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Max. Marks for internal test | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Cryptography and Network Security

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE780EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 To introduce the foundational concepts of network security, including types of attacks, services, and mechanisms, as well as classical and modern encryption techniques.<br>2 To equip students with the knowledge of symmetric and asymmetric encryption algorithms for securing data communication.<br>3 To enable learners to understand authentication methods and integrity mechanisms.<br>4 To familiarize students with network and web security architectures, including IPsec, SSL/TLS, SET, and firewall design.<br>5 To explore real-world threats and AI-driven security solutions, such as malware (viruses, worms), intrusion detection, and advanced authentication systems for robust cybersecurity in modern networks. | On completion of the course, students will be able to<br>1. Identify and analyse different types of security threats, attacks, and mechanisms in network systems.<br>2. Apply symmetric and asymmetric cryptographic algorithms to ensure confidentiality and secure key exchange.<br>3. Evaluate and implement authentication mechanisms using hash functions, digital signatures, and secure email protocols.<br>4. Analyze the architecture and functioning of IP and web security protocols.<br>5. Design and assess secure network systems using firewalls, intrusion detection, and AI-driven security tools for threat detection and prevention. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO2 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO3 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO4 | 2 | 2 | | 3 | | | | | | | | | | 3 | |
| CO5 | 3 | 2 | 3 | | | | | | | | | 3 | | 3 | |

**UNIT - I:**

Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption

Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

**UNIT-II:**

Encryption: Triple DES, International Data Encryption algorithm, Characteristics of Advanced Symmetric block ciphers. Conventional Encryption Placement of Encryption function

**UNIT-III:**

Public Key Cryptography Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange , Number Theory in brief.

**UNIT-IV:**

Message Authentication and Hash Functions Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications Kerberos, Electronic Mail Security: Pretty Good Privacy, S/MIME

**UNIT-V:**

IP Security Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted systems. Case studies and tools for AI-driven security solutions in web applications, including secure authentication and fraud detection.

**Learning Resources:**

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
3. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
https://nptel.ac.in/courses/106105031/

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Cryptography and Network Security Lab

(Professional Elective-II)
SYLLABUS FOR B.E. (ECE) VII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 0:0:2 | SEE Marks : 50 | Course Code: **U22PE781EC** |
| Credits : 1 | CIE Marks : 30 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce classical encryption and decryption techniques, including substitution and transposition ciphers, for secure message transmission.<br>2. To enable students to implement and evaluate modern cryptographic algorithms, such as DES, AES, RSA, MD5, and SHA-1, through programming exercises.<br>3. To develop practical skills in key exchange protocols and digital signature schemes, facilitating secure communication and authentication.<br>4. To expose students to open-source tools and platforms for configuring firewalls, conducting vulnerability assessments, and simulating network attacks.<br>5. To build hands-on experience in packet analysis and intrusion detection, using tools like Wireshark, KF Sensor, and network simulation environments. | On completion of the course, students will be able to<br>1 Develop code for classical Encryption Techniques to solve the problems.<br>2 Build cryptosystems by applying symmetric and public key encryption algorithms.<br>3 Construct code for authentication algorithms.<br>4 Develop a signature scheme using Digital signature standard.<br>5 Demonstrate the network security system using open-source tools |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 3 | | | 2 | | | | | | 3 | |
| CO2 | 3 | 2 | | | 3 | | | 2 | | | | | | 3 | |
| CO3 | 3 | 2 | | | 3 | | | 2 | | | | 3 | | 3 | |
| CO4 | 2 | 2 | 3 | | 3 | | | 2 | | | | | | 3 | |
| CO5 | 3 | 2 | | 2 | 3 | 3 | | 2 | | | | 3 | | 3 | |

**LIST OF EXPERIMENTS:**

**Cycle 1**

1. Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher iv) Vigenère cipher.

2. Perform encryption and decryption using following transposition techniques i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Connect remote machine using Secure Shell (SSH)
5. Apply AES algorithm for practical applications.
6. Implement RSA Algorithm

**Cycle-2**

1. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
2. Calculate the message digest of a text using the MD5 algorithm.
3. Basic firewall configuration in packet tracer.
4. Write the RC4 logic using cryptography. Encrypt the text 'Hello world' using blowfish.
5. Calculate the message digest of a text using the SHA-1 algorithm.
6. Working With KF Sensor Tool for Creating and Monitoring Honeypot.

**New additional experiments**

1. Use network analysis tools and design simple intrusion detection rules.
2. Capture ICMPv4 packets generated by utility programs and tabulate all the captured parameters using Wireshark.
3. Understand protocol-level concepts for authentication and key exchange**.**

**Learning Resources:**

1. Build Your Own Security Lab, Michael Gregg, Wiley India

**LIST OF EQUIPMENT :**

SOFTWARE: C / C++ / Java/Python or equivalent compiler GnuPG, KF Sensor /Snort, N-Stalker or Equivalent HARDWARE: **Standalone desktops –**

The break-up of CIE:

| | | | |
|---|---|---|---|
| 1. | No. of Internal Test | : | 1 |
| 2. | Max. Marks for internal test | : | 12 |
| 3. | Marks for day-to-day laboratory class work | : | 18 |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS) :: IBRAHIMBAGH, HYDERABAD – 500 031.
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EXAMINATION **(R-22)** :: B.E. – ECE : EIGHTH SEMESTER (2025 - 26)

| **B.E (ECE) VIII – SEMESTER** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Course Code | Name of the Course | Scheme of Instruction | | | Scheme of Examination | | | Credits |
| | | Hours per Week | | | Duration in Hrs | Maximum Marks | | |
| | | L | T | P | | SEE | CIE | |
| **THEORY** | | | | | | | | |
| U22PE8XXEC | Professional Elective – III | 3 | - | - | 3 | 60 | 40 | **3** |
| U22PE8XXEC | Professional Elective – IV | 3 | - | - | 3 | 60 | 40 | **3** |
| **PRACTICALS** | | | | | | | | |
| U22PW819EC | Project / Internship | - | - | 12 | Viva-Voce | 50 | 50 | **6** |
| | **TOTAL** | **6** | **-** | **12** | | **170** | **130** | **12** |
| | **GRAND TOTAL** | **18** | | | | **300** | | |

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Project / Internship

SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week): 0:0:12 | SEE Marks : 50 | Course Code: **U22PW819EC** |
| Credits : 6 | CIE Marks : 50 | Duration of SEE : Viva-Voce |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce students to the process of identifying and defining complex engineering problems with real-world relevance and societal impact.<br>2. To equip students with the skills necessary to design appropriate solutions using scientific principles, engineering knowledge, and consideration of sustainability and ethics.<br>3. To train students in the use of modern engineering tools and techniques for simulation, modelling, analysis, and interpretation of data.<br>4. To develop students abilities in technical communication, including the preparation of professional reports and presentations in accordance with ethical standards.<br>5. To foster teamwork, leadership, and project management skills, encouraging adaptability to technological advancements and resource optimization | On completion of the course, students will be able<br>1. To select the complex engineering problems beneficial to the society and develop solutions with appropriate considerations<br>2. To apply modern tools and analyze the results to provide valid conclusions.<br>3. To communicate effectively the solutions with report and presentation following ethics<br>4. To work in teams and adapt for the advanced technological changes<br>5. To apply management principles to complete the project economically |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | | | 2 | 3 | | | | | 3 | | | |
| CO2 | | | | 3 | 3 | | | | | | | 3 | | | |
| CO3 | | | | | | | | 3 | | 3 | | | | | |
| CO4 | | | | | | | | | 3 | | | 3 | | | |
| CO5 | | | | | | | | | 2 | | 3 | | | | |

**Note:** Some of relevant COs must be mapped with the relevant PSOs based on the domain and application area of the project.

Oral presentation is an important aspect of engineering education. The objective of the project is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her

specialization.

Project topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of project work carried out.

**Each student is required to:**

1. Submit a one-page synopsis in the beginning of project work for display on the notice board.
2. Give a 20 minutes presentation through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the project work with list of references and slides used.

Project reviews are to be scheduled from the 3rd week of the semester to the last week of the semester and any change in schedule should be discouraged.

- Batch size shall be 2 (or) 3 students per batch.
- Project allocation by department.
- Two reviews – One during 5th week and another during 10th week and final evaluation shall be conducted during 15th to 16th week.
- Students are required to give Presentations during the reviews.
- Students are required to submit project report.

**Continuous Internal Evaluation (CIE) – 50 marks:**

| Evaluation Criteria | Maximum Marks |
|---|---|
| Literature Survey | 10 |
| Problem Formulation | 10 |
| Design/ Methodology | 10 |
| Implementation & Results | 10 |
| Presentation & Documentation | 10 |

**Semester End Examination (SEE) – 50 marks:**

| Evaluation Criteria | Maximum Marks |
|---|---|
| Literature Survey | 10 |
| Problem Formulation | 10 |
| Design/ Methodology | 10 |
| Implementation & Results | 10 |
| Presentation & Documentation | 10 |

**Note:** Rubrics are used for assessment and evaluation.

# B.E (ECE) VIII - Semester

## Professional Electives

## (R-22)

## for the Academic Year: 2025 - 2026

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Real Time Systems

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE810EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce the fundamentals of real-time systems, including task types, job classifications, and scheduling needs.<br>2. To understand and apply real-time scheduling algorithms, such as RM, EDF, and LST, in both uniprocessor and multiprocessor systems.<br>3. To analyze resource-sharing issues and implement protocols for priority inversion and deadlock avoidance.<br>4. To explore features of commercial RTOS like VxWorks, µCOS, and RTLinux, including memory, I/O, and interrupt handling.<br>5. To study fault-tolerance techniques and apply RTOS in domains like image processing, VoIP, and control systems. | On completion of the course, students will be able to<br>1. Differentiate the design principles for hard and soft real time systems.<br>2. Compare different scheduling algorithms and the schedulability criteria for a real time system.<br>3. Determine schedulability of a set of periodic tasks when sharing resources avoiding dead lock.<br>4. Compare different commercial RTOS and choose specific type for a particular application.<br>5. To analyze evaluation techniques and reliability models for Hardware Redundancy |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | | 3 | | |
| CO2 | 2 | 2 | 2 | | | | | | | | | | 1 | | |
| CO3 | 2 | 2 | 2 | | | | | | | | | | 1 | | |
| CO4 | 1 | 2 | 2 | | | | | | | | | | 1 | | |
| CO5 | 1 | 1 | 3 | | | 2 | | | | | | | 3 | 2 | 2 |

## UNIT - I : Real Time System Characteristics

Introduction to RTS, Types of RTS, Task Types, Jobs – Periodic, Sporadic, Aperiodic, Applications of RTS, Predictability, Reference Model, Types of schedulers, Cyclic and Priority based Schedulers and problem analysis

## UNIT - II : Real Time Schedulers

Cyclic, priority based schedulers – static/dynamic – RM, EDF, LST, Optimality of EDF, Non-optimality of EDF, Scheduling with precedence

constraints, Multiprocessor scheduling – static and dynamic systems, Problems of Predictability in multi-processor systems, Preemptive and non-preemptive priority based scheduling in uniprocessor systems.

**UNIT - III : Resource sharing and Deadlock avoidance**

Resource Control Model, Priority Inversion, Uncontrolled Priority Inversion, Disadvantages of Priority inversion, Priority Inheritance Protocol, Deadlocks due to Priority Inheritance Protocol, Priority Ceiling Protocol, Deadlock Avoidance, Analysis of Priority Ceiling Protocol, Stack Sharing Priority Ceiling Protocol, Priority Ceiling Protocol in Dynamic Priority Systems, Multiple units of resources, Priority ceiling, Preemption ceiling and stack based preemption ceiling protocol.

**UNIT - IV : Commercial RTOS**

Unix and Windows as RTOS, Real-time POSIX, Different Types of commercial RTOS, features of VxWorks, µCOS and RTLINUX. Memory, I/O management policies and Interrupt handling in Different RTOS.
Comparison and study of RTOS: Vxworks and µCOS

**UNIT - V: Fault-Tolerance Techniques & RTOS Application Domains**

What causes failures, Fault types, Fault detection, Hardware and software Redundancy.
Case studies: RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

**Learning Resources:**

1 uC/OS-III: The Real-Time Kernel and the Freescale Kinetis ARM Cortex-M4 Hardcover, 2011, Micrium, ISBN-13: 978-0982337523.
2 Jane W S Liu, "Real Time Systems" 2018 edition, Pearson, India.
3 David E. Simon "An Embedded Software Primer" Addison-Wesley publisher, 2004, ISBN 020161569X.
4 https://nptel.ac.in/courses/106105036/

The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Low Power VLSI Design

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE811EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To understand the physical mechanisms of power dissipation in deep submicron CMOS technologies and their limitations.<br>2. To study CMOS device characteristics, fabrication technologies, and their influence on power and performance.<br>3. To explore dynamic power consumption components and analyze circuit-level techniques for dynamic power reduction.<br>4. To examine leakage current components and investigate advanced circuit techniques to minimize static power consumption.<br>5. To design and evaluate low-power arithmetic building blocks and understand trade-offs between power and performance. | On completion of the course, students will be able to<br>1. Understand the basics of VLSI technology.<br>2. Apply the physics of power dissipation.<br>3. Analyze the circuit techniques for dynamic power dissipation.<br>4. Apply the circuit techniques for leakage reduction.<br>5. Design low power arithmetic operators. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 2 | | | | | | | | 3 | | |
| CO2 | 2 | 2 | 3 | | | | | | | | | | 3 | | |
| CO3 | 2 | 2 | 2 | | 2 | | | | | | | | 3 | | |
| CO4 | | 2 | 3 | 3 | 2 | | | | | | | | 3 | | |
| CO5 | | 2 | 2 | | 2 | 2 | | | | | | 3 | 3 | | |

**UNIT - I :**

Physics of power dissipation in CMOSFET devices: introduction, Submicron MOSFET, Power dissipation in CMOS, short circuit dissipation, dynamic dissipation, load capacitance, Body Effect, Short Channel Effects, MOS Capacitances, Hot Carrier Effects.

**UNIT - II :**

CMOS Technology and Devices: Evolution of CMOS Technology, BiCMOS Technology, SOI CMOS Technology, Threshold Voltage , Narrow Channel Effects, Mobility & Drain Current, Subthreshold Current, Electron

Temperature, Velocity Overshoot.

**UNIT - III :**

Circuits Techniques for Dynamic Power Reduction: Dynamic Power Consumption Components, Circuit Parallelization, Memory Parallelization, Voltage Scaling-Based Circuit Techniques: Multiple Voltages Techniques, Low Voltage Swing, Precomputation, Retiming, Gated Clocks, Circuit Technology-Dependent Power Reduction, Path Balancing.

**UNIT - IV :**

Circuit Techniques for Leakage Reduction: Leakage Components, Subthreshold Leakage Gate Leakage, Source/Substrate and Drain/Substrate P-N Junction Leakage, Circuit Techniques to Reduce Leakage in Logic, Dual Threshold CMOS, Multiple Supply Voltage, Runtime Standby Leakage Reduction Techniques, Leakage Control Using Transistor Stacks (Self-Reverse Bias), Sleep Transistor, Dynamic Vdd Scaling (DVS) • Dynamic Vth Scaling (DVTS).

**UNIT - V :**

Low-Power Arithmetic Operators : Introduction, Addition, 1-Bit Addition Cells, Sequential Adder, Propagate and Generate Mechanisms, Carry Select Adder, Carry Skip Adder, Logarithmic Number System, Logarithmic Adders, Power/Delay Comparison.

**Learning Resources:**

1. Low power CMOS circuits technology, logic design and cad tools by Chtristian piguet.
2. Low power CMOS VLSI circuit design by Koushik Roy & Sharath prasad.
3. Low-Voltage CMOS VLSI Circuits , James B. Kuo
4. https://onlinecourses.nptel.ac.in/

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Satellite Communication

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE820EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 To understand the working principles of various satellites and their importance in global communication<br>2 To acquire the knowledge on satellite sub systems and various factors affecting the function of communication satellite.<br>3 To design satellite uplink and down link with noise margin<br>4 To study the need of multiple access techniques and various protocols being used in satellite communications<br>5 To provide the details and applications of various Indian satellite systems | On completion of the course, students will be able to<br>1 Apply Kepler's law to find satellite orbital parameters.<br>2 Describe satellite subsystems like telemetry, tracking and command control.<br>3 Analyze Satellite link design<br>4 Describe the various multiple access techniques.<br>5 Understand the importance of special purpose communication satellite and their applications. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | 2 | | | | | | | | 3 | |
| CO2 | 3 | 2 | | | | 2 | | | | | | | | 3 | |
| CO3 | 3 | 2 | | | | 2 | | | | | | | | 3 | |
| CO4 | 3 | 2 | | 3 | | 2 | | | | | | | | 3 | |
| CO5 | 3 | 2 | | | | 2 | | | | | | 3 | | 3 | |

**UNIT – I**

Evolution and growth of communication satellites, synchronous satellites, frequency allocation, orbits, orbital mechanism and kepler's laws, effects of orbital inclination, azimuth and elevation, range and angle, eclipse, placements of a satellite in geo-stationery orbit.

**UNIT – II**

Space segment, stabilization, communication sub systems, Telemetry,

tracking and command, Attitude & orbital Control Systems, Power Systems, Earth segment, large and small Earth station antennas, Redundancy configuration, Thermal System.

**UNIT - III**

System noise temperature and G/T ratio, Basic RF link analysis, EIRP, C/N, Interference, attenuation due to rain, cross polarization, design of uplink and down link

**UNIT - IV**

Multiple access techniques, SCPC companding systems, TDMA frame structure, Frame efficiency, Super frame structure, frame acquisition and synchronization, types of demand assignments, SPADE.

**UNIT - V**

Special purpose communication satellites, INTELAST, Global Positioning System, Echo- Cancellation techniques, Protocols, Satellite applications, Introduction to NavIC system Indian activities in satellite communication. Indian Scientific satellites

**Learning Resources:**

1. Timothy Pratt and Charles W. Bostan, Satellite Communications, 2003.
2. Dr. D.C Agarwal, Satellite Communications 7th Edition, Khanna Publishers, 1996
3. Tri-T-ha, Digital Satellite Communications, 2nd Edition, McGraw Hill, 1990.

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Optical Fiber Communication

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE821EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Describe the principles fiber-optic communication, the components and the bandwidth advantages.<br>2. Apply the properties of the optical fibers and optical components.<br>3. Use optical sources and detectors for various applications.<br>4. Analyze system performance of optical communication systems.<br>5. Design optical networks and understand non-linear effects in optical fibers. | On completion of the course, students will be able to<br>1 Describe the principles fiber-optic communication, the components and the bandwidth advantages.<br>2 Apply the properties of the optical fibers and optical components.<br>3 Use optical sources and detectors for various applications.<br>4 Analyze system performance of optical communication systems.<br>5 Design optical networks and understand non-linear effects in optical fibers. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | | 1 | 3 | |
| CO2 | 2 | 2 | 3 | 2 | | | | | | | | | | 3 | |
| CO3 | 1 | 2 | | | | | | | | | | | 2 | 3 | |
| CO4 | 2 | 3 | | 3 | | | | | | | | 3 | | 3 | |
| CO5 | 2 | 2 | | | | 2 | | | | | | 3 | | 3 | 3 |

**UNIT – I:**

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

**UNIT - II:**

Different types of optical fibers, Modal analysis of a step index fiber.
Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

**UNIT - III:**
Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

**UNIT - IV:**
Optical switches - coupled mode analysis of directional couplers, electro-optic switches. Optical amplifiers - EDFA, Raman amplifier. WDM and DWDM systems. Principles of WDM networks

**UNIT - V:**
Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication.

**Learning Resources:**

1 J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2 G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, 3rd Ed, 2002.
3 K.C. Gupta, Opto Electronic Devices and Systems, PHI Learning, 2005.
4 https://nptel.ac.in/courses/117101054/
5 https://nptel.ac.in/courses/117104127/

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. No. of Internal Tests | : | 2 | Max. Marks for each Internal Test | : | 30 |
| 2. No. of Assignments | : | 3 | Max. Marks for each Assignment | : | 5 |
| 3. No. of Quizzes | : | 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Image and Video Processing Using Machine Learning

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE830EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Develop a solid foundation in machine learning principles<br>2. Provide technical details on Decision Trees and Bayesian Networks<br>3. Emphasize concepts on Support Vector Machines and clustering techniques<br>4. Cover various deep learning techniques<br>5. Train with real-world applications | On completion of the course, students will be able to<br>1 Describe the basic concepts of Machine Learning<br>2 Apply Machine Learning techniques suitable for a given problem.<br>3 Apply Deep Learning techniques suitable for a given problem.<br>4 Analyze the performance of various models using appropriate metrics.<br>5 Design and implement various machine learning algorithms in a range of real-world applications. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | | 2 |
| CO2 | 2 | 3 | | | 2 | | | | | | | | | | 3 |
| CO3 | 2 | 3 | | | 2 | | | | | | | | | | 3 |
| CO4 | 2 | 2 | | 3 | 2 | | | | | | | | | | 3 |
| CO5 | 2 | 2 | 3 | 2 | 3 | 2 | | | | | | 3 | | | 3 |

**UNIT - I :**

Introduction to Machine learning, Core concepts, Data inconsistencies, Practical Machine learning applications, Types of learning problems, Machine learning architecture, Machine learning algorithms.

Linear Regression, Cost Function, Gradient Descent and Logistic Regression.

**UNIT - II :**

Working with Decision tress: Basics of Decision trees, uses, Advantages, Limitations, different algorithm types - ID3, C4.5, CART

Bayesian Networks: Graph theory, probability theory, Bayes theorem, working of Bayesian Networks.

**UNIT - III :**

Support vector Machines: Definition of SVM, uses of SVM, Basic classification principles, How Support Vector Machines Approach classification.

Combining Classifiers using Boosting

Clustering: Definition of clustering, clustering types-K-means, Agglomerative hierarchical, DBSCAN.

**UNIT - IV :**

Deep learning: Background, Deep learning Taxonomy, Hebbian learning, Perceptron Learning, Back propagation, Convolutional Neural networks, Recurrent Neural Networks, Autoencoders.

**UNIT - V :**

Applications of Machine learning: Image retrieval, Face recognition, Video classification. Image Segmentation using K-means clustering, Satellite Image Classification using Decision Trees. Image/Video Classification using CNN, Performance analysis of various algorithms.

**Learning Resources:**


1 Machine Learning, Tom M. Mitchell, 1st Edition, McGraw-Hill Education; 1st edition, 2017.
2 Introduction to Machine Learning, Ethem Alpaydin, third edition, PHI.
3 Machine Learning for Big Data: Hands on for developers and technical professionals wiley publications, 2018 by Jason Bell.
4 Practical Machine Learning. Sunila Gollapudi, Packt publishers, 2016.
5 https://nptel.ac.in/courses/106/105/106105152/
6 https://nptel.ac.in/courses/106106139/


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Speech and Audio Signal Processing

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE831EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 To understand the mechanism of speech production.<br>2 To analyze various speech synthesizers.<br>3 To study various types of coders and decoders.<br>4 To design Automatic speech recognition system (ASR) by pattern matching method.<br>5 To analyze speaker identification and verification systems. | On completion of the course, students will be able to<br>1 Apply the knowledge of science to design an artificial model of speech production system.<br>2 Analyse the types of speech signals & convert the signals to digital.<br>3 Synthesize the speech signal using a text as input.<br>4 Design speech encoder and decoder.<br>5 Design an Automatic speech recognition system (ASR) by pattern matching method. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | | | 2 | | | | | 3 | 2 | | | 3 |
| CO2 | 2 | 3 | 2 | 4 | | | | | | | 2 | 2 | | | 3 |
| CO3 | 2 | 3 | 3 | | | 2 | | | | | 2 | 2 | | | 3 |
| CO4 | 3 | 3 | 3 | | | | | | | | 3 | 2 | | | 3 |
| CO5 | 2 | 3 | 3 | | | 2 | | | | 2 | 2 | 1 | | | 3 |

**UNIT - I :**

Applications of Digital Speech Processing, Phonetic Representation of Speech, Models for Speech Production-Schematic model of the vocal tract system, Source filter model for a speech signal production. Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization.

**UNIT - II :**

Short-Time Analysis of Speech-Short-Time Energy and Zero-Crossing Rate, Short-Time Autocorrelation Function (STACF), Short-Time Fourier

Transform (STFT), The Speech Spectrogram, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using a parallel processing approach, the Short time autocorrelation function, Average magnitude function, Pitch period estimation using the autocorrelation function. Linear Predictive Coding (LPC) Analysis. Homomorphic Speech Analysis.

**UNIT - III :**

Speech Synthesis Methods, Linear predictive synthesizer, phone use synthesis, Introduction to Text-to-Speech and Articulator speech synthesis.

**UNIT - IV :**

Lossless Audio Coding, Lossy Audio coding, Sub-band coding, Transforms coding, channel decoder, Formant decoder, Cepstral decoder, linear predictive decoder, vector quantizer coder.

**UNIT - V :**

Automatic Speech Recognition (ASR), The Problems and Challenges in Automatic Speech Recognition, Building a Speech Recognition System, The Decision Processes in ASR, Representative Recognition Performance, Automatic Speaker Recognition: Recognition techniques, Dynamic Time warping method of speech pattern recognition, Technology.

**Learning Resources:**

1. Lawrence R. Rabiner and Ronald W. Schafer, "Introduction to Digital Speech Processing", now, 2007.
2. Owens F.J., "Signal Processing of Speech", Macmillan, 2000.
3. Daniel Jurefskey & James H. Martin, "Speech and Language Processing", Pearson Education, 2003.
4. https://nptel.ac.in/courses/117105145/
5. https://onlinecourses.nptel.ac.in/noc22_ee117/preview
6. https://www.udemy.com/course/digital-speech-processing/

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Wireless Sensor Networks

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE840EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce the fundamental concepts, characteristics, and challenges of Wireless Sensor Networks (WSNs).<br>2. To familiarize students with the single-node architecture including hardware components, energy consumption models, and the design trade-offs in sensor node development.<br>3. To explore networking aspects of WSNs, such as transceiver design, MAC protocols, routing algorithms, and their optimization goals.<br>4. To impart knowledge on infrastructure establishment, including topology control, clustering mechanisms, time synchronization, localization, and sensor tasking.<br>5. To provide hands-on insight into sensor network platforms and tools, covering simulation environments, node-level software, operating systems, and real-world engineering applications. | On completion of the course, students will be able to<br>1 Analyze Wireless Sensor Network Characteristics and its challenges; and, differentiate WSN with other ad-hoc networks.<br>2 Illustrate the architecture of Single WSN mote with Energy consumption mathematical models of a single mote both during the transmission and reception.<br>3 Apply Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks and their comparisons<br>4 Analyze different topology control and clustering schemes with localization concepts.<br>5 Describe some of the widely used WSN simulation tools and platforms with engineering case studies. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | | | | | 3 | |
| CO2 | 3 | 3 | 2 | | | | 3 | | | | | | | 3 | 3 |
| CO3 | 3 | 3 | 2 | | | | | | | | | | | 3 | |
| CO4 | 2 | 3 | 2 | 3 | | | | | | | | | | 3 | |
| CO5 | 3 | 3 | 2 | | 3 | 2 | | | | | | | | 3 | |

## UNIT-I: OVERVIEW OF WIRELESS SENSOR NETWORKS

Challenges for Wireless Sensor Networks Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor

networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks

**UNIT-II: ARCHITECTURES**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concept

**UNIT-III: NETWORKING SENSORS**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, Zigbee: IEEE 802.15.4 MAC Layer, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

**UNIT-IV: INFRASTRUCTURE ESTABLISHMENT**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

**UNIT-V: SENSOR NETWORK PLATFORMS AND TOOLS**

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware -Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

**Learning Resource:**

1. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks," John Wiley, 2005.
2. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach," Elsevier, 2007.
3. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks- Technology, Protocols and Applications," John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs," John Wiley, 2003.
5. https://nptel.ac.in/courses/106105160/21

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Optical Networks

(Professional Elective-III)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE841EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Understand the fundamentals of SONET/SDH and the architecture of optical transport networks.<br>2. Explore WDM network components including OLTs, OADMs, and optical cross-connects.<br>3. Learn control and management functions within optical layers for efficient network operation.<br>4. Analyze survivability strategies and protection mechanisms in optical and client layers.<br>5. Design WDM and access networks using routing, wavelength assignment, and performance models. | On completion of the course, students will be able to<br>1 Implement SONET for communication.<br>2 Contribute in the areas of optical network and WDM network design.<br>3 Implement simple optical network and understand further technology developments for future enhanced network.<br>4 Contribute in the area of network survivability.<br>5 Design WDM Network |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | | 1 | 3 | |
| CO2 | 2 | 2 | 2 | 2 | | | | | | | | | | 3 | |
| CO3 | 1 | 2 | | | | | | | | | | | 2 | 3 | |
| CO4 | 2 | 3 | | | | | | | | | | 2 | | 3 | |
| CO5 | 2 | 2 | 3 | | | 2 | | | | | | 2 | | 3 | 3 |

**UNIT - I:**
SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol label switching.

**UNIT - II:**
WDM network elements: optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

**UNIT - III :**

Control and management: network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety.

**UNIT - IV :**

Network Survivability: protection in SONET/SDH & client layer, optical layer protection Schemes.

**UNIT - V :**

WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models. Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

**Learning Resources:**

1 Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3rd edition, 2010.
2 C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design,and Algorithms", PHI, EEE, 2001

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. No. of Internal Tests | : | 2 | Max. Marks for each Internal Test | : | 30 |
| 2. No. of Assignments | : | 3 | Max. Marks for each Assignment | : | 5 |
| 3. No. of Quizzes | : | 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Industrial IoT and Applications

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE850EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To understand the evolution of Industry 4.0 and the foundational principles of IIoT systems.<br>2. To explore the role and architecture of Cyber-Physical Systems (CPS) and Next Generation Sensors in Industry 4.0<br>3. To analyze key enablers of IIoT such as processing topologies, supervisory control systems, and security frameworks.<br>4. To examine the integration of advanced technologies in IIoT.<br>5. To evaluate real-world IIoT implementations through industry-specific case studies | On completion of the course, students will be able to<br>1. Explain the basics of Industry 4.0 and the IIoT architecture with key communication protocols like Zigbee and Wireless HART.<br>2. Compare embedded systems and cyber-physical systems and describe the features and uses of next-generation sensors.<br>3. Identify the needs and challenges of IIoT processing and explain the importance of multi-level security in IIoT systems.<br>4. Describe the role of advanced technologies like SDN and Smart Factories in modern industrial applications.<br>5. Analyze real-world IIoT case studies and explain their architecture, challenges, and benefits in various industries. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | | | | | | | | | 1 | 1 | 3 | |
| CO2 | 2 | 2 | 1 | | | | | | | | | 1 | 3 | | |
| CO3 | 2 | 2 | 1 | | | | | | | | | 1 | 1 | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | 1 | 1 | 1 | 1 |
| CO5 | 3 | 1 | 1 | 1 | | 3 | | | | | | 1 | 1 | 1 | 1 |

**UNIT-I: Introduction to Industrial IoT (IIoT) Systems & IIoT Reference Architecture**

The Industrial 4.0 Revolutions, Industrial Internet Architecture Framework (IIAF), Five Functional domains of IIAF, IIoT- Sensing and Actuation, IIoT connectivity with IEEE 802.15.4,Zigbee,6LoWPAN,Wireless HART. Industry 4.0: Globalization and Emerging Issues, Sustainability assessment of Emerging issues, LEAN Production System in Industry 4.0.IIoT Vs Automation.

**UNIT-II: Cyber physical systems and Next generation sensors in Industry 4.0**

Features of Cyber physical systems, Difference between Embedded system and

cyber physical system, Cyber physical systems architecture for IIoT, Challenges for Cyber physical system development, Introduction to Next generation sensors, Comparision of smart senors with next generation sensors, Architecture frame work for Next generation sensors,Applications of next generation sensors, Design challenges for Next generation sensors in Industry 4.0 . Challenges for Industrial Processes in Industry 4.0.

**UNIT-III: Key Enablers of Industrial IoT Processing & Security in IIoT**

Necessity of IIoT processing, Challenges in IIoT processing, IIoT Supervisory control and Management, Ongoing research in IIoT processing - Processing topologies, Semantic rules in processing, Necessity of security in IIoT, Security Goals, Standards for IIoT security, Architecture frame work for Operational technology (OT) ,Security at different levels- Network level, System level. Introduction to IIoT analytics.

**UNIT-IV: Advanced Technologies in IIoT**

Software defined Networking- Architecture, Design Aspects, Applications and Advantages. Smart Factory- Architecture, Features, Applications and Advantages, Health care- Architecture, Challenges, Advantages, Applications. IIoT in power Plants- Architectural frame work, Design challenges, Applications and Advantages.

**UNIT-V: IIoT Case Studies**

Case Study analysis in Chemical & pharmaceutical industry, Case Study analysis in Unmanned Aerial Vehicles(UAV), Case study analysis in Energy management, Case study analysis in Industrial monitoring system, Case study analysis in Oil & Gas Industry.

**Note:** Every case study includes- Architecture Frame work, Design challenges, Role of IIoT, advantages and applications.

## Learning Resource:


1. Industry 4.0: The Industrial Internet of Things Alasdair GilchristPublications: Apress 2018.
2. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press.Availability: https://www.amazon.in/Introduction-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1
3. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. Availability: https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3
4. https://onlinecourses.nptel.ac.in/noc23_cs52- Introduction to Industry 4.0 and Industrial Internet of Things


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# FPGA Architectures and Applications

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE851EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Understand the fundamentals of memory types, PLDs, and programmable architectures including ROM, RAM, PLA, PAL.<br>2. Explore various types of Sequential PLDs and their use in designing finite state machines.<br>3. Examine the architecture and internal components of Field Programmable Gate Arrays (FPGAs).<br>4. Analyze FPGA placement and routing techniques to optimize logic implementation.<br>5. Apply digital design flow, verification, and testing methodologies for FPGA-based systems. | On completion of the course, students will be able to<br>1 Identify and differentiate various types of programmable logic devices (PLDs) and memory types.<br>2 Design digital systems using PLAs, PALs, and sequential PLDs.<br>3 Analyze FPGA architectures and evaluate their components and performance characteristics.<br>4 Apply placement and routing algorithms for efficient logic synthesis in FPGAs.<br>5 Demonstrate FPGA design flow, testing techniques, and verification procedures. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | | | | | | | 3 | 3 | | |
| CO2 | 3 | 3 | 2 | | | | | | | | | 3 | 3 | | |
| CO3 | 3 | 2 | 2 | | | | | | | | | 3 | 3 | | |
| CO4 | 2 | 3 | 3 | | | | | | | | | 3 | 3 | | |
| CO5 | 2 | 2 | 2 | | | | | | | | | 3 | 3 | 1 | 1 |

**UNIT-I: Introduction to PLD's and PGA'S**

Memory- Read-only memory, read/write memory - SRAM and DRAM. Programmable Logic Devices-PLAs, PALs and their applications; Sequential PLDs and their applications; State- machine design with sequential PLDs; Programmable gate arrays (pgas), Introduction to field programmable gate arrays (FPGAs),design flow using FPGA, programming technologies.

**UNIT-II: FPGA Architectural Aspects**

Organization of FPGAs, Programmable Logic Block Architectures,

Programmable Interconnect, Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs. XILINX XC4000 Architecture, Routing Structure, Actel FPGA's Architecture, AMD FPGA architecture, Altera FPGA Architecture. Comparision of Architectural features of Commercial FPGAs

**UNIT-III: Placement, Routing Algorithms and Static Timing analysis in FPGA Architectures**

Placement: objectives, placement algorithms: Mincut-Based placement, iterative improvement placement, simulated annealing. Routing: objectives, segmented channel routing, Maze routing, Routability estimation, Net delays, computing signal delay in RC tree networks. Timing analysis in combinational circuits, timing analysis in sequential circuits.

**UNIT-IV: Testing methods in FPGA Architectures and Logic Optimization**

Stuck at faults, ATPG methods, LFSR, Scan path design, BIST Architecture, programmability failures, Fault coverage, System/Network-on-chip testing-Modular testing. Logic block functionality versus area-efficiency, Logic block area and routing model, Impact of logic block functionality on FPGA performance

**UNIT-V: FPGA Application Domains**

Comparison of ASIC and FPGA, Advantages of FPGAs.

**Case study:** Machine Learning application using FPGAs, Artificial Intelligence in FPGAs, Hardware Accelerators in FPGA Design, Generative AI using FPGAs, FPGAs in High level synthesis flow, FPGA based task scheduler for Real time systems.

**Learning Resources:**

1. S. Brown, R. Francis, J. Rose, Z.Vransic, "Field Programmable Gate array", BSP, 2007.
2. P.K. Chan & S. Mourad, "Digital Design Using Field Programmable Gate Array", Pearson Education 2009.
3. Spartan-3A/3AN FPGA Starter Kit Board User Guide, 2010.
4. S. Trimberger, Edr., "Field Programmable Gate Array Technology", Kluwer Academic Publications, 2004.
5. https://nptel.ac.in/syllabus/117108040/prof.Kuruvilla Varghese IISC Banglore.

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Radar and Navigation Systems

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE860EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 Derive and understand the Radar range equation and the parameters<br>2 Analyze the working of pulse, continuous wave and Moving target indicating radars<br>3 Understand the different Navigational methods<br>4 Understand the direction of arrival techniques<br>5 Explore the different hyperbolic Navigation systems | On completion of the course, students will be able to<br>1 Derive and evaluate Radar range equation and nature of detection<br>2 Describe the continuous and moving target indicator radars.<br>3 Interpret techniques and functionalities of various tracking radar systems.<br>4 Explain principles of navigation including the operation of approach and landing aids.<br>5 Describe and assess the features and applications of satellite-based navigation systems. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | 2 | | 3 | | | | | | 2 | | 3 | |
| CO2 | 3 | 3 | | 2 | | 3 | | | | | | 2 | | 3 | |
| CO3 | 3 | 3 | | 2 | | 3 | | | | | | 2 | | 3 | |
| CO4 | 3 | 2 | | 2 | | 3 | | | | | | 2 | | 3 | |
| CO5 | 3 | 2 | | 2 | | 3 | 3 | | | | | 2 | | 3 | |

**UNIT - I :**

Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

**UNIT - II :**

Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, blind speeds, delay line cancellers, staggered PRF, limitations to the performance of MTI radar.

**UNIT - III :**

Tracking radars: Sequential lobing, Conical scan, Monopulse: amplitude comparison and phase comparison methods, Radar antennas. Radar displays. Duplexer.

**UNIT - IV :**

**Direction Finding -** Four methods of Navigation, Loop Antenna as direction finding, An Aural Null Direction Finder, Adcock Direction Finders, Direction Finding at Very High Frequencies: The LF/MF Four course Radio Range, VHF Omni Directional Range(VOR), Errors in Direction Finding.

**UNIT - V :**

**Hyperbolic Navigation Systems:** Principle of Hyperbolic Navigation Systems: Loran and Decca and Omega System, GPS principle and operation, Position location determination and applications.

**Learning Resource:**


1. Merrill I. Skolnik, "Introduction to Radar Systems", 2nd Edition Tata Mc Graw-Hill 2017.
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.
3. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004 2. J.C Toomay, "Principles of Radar", 2nd Edition –PHI, 2004.
4. Radar Systems and Radio Aids to Navigation, Sen & Bhattacharya, Khanna publishers
5. NPTEL Links: https://nptel.ac.in/courses/101108056/3


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Global Positioning System

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE861EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 To study basics of mathematics and science related to GNSS constellations<br>2 To understand the different coordinates for representation user position.<br>3 To study the different errors of GPSs 5 To acquire the knowledge of augmentation systems.<br>4 To understand the GPS data formats for use of different application<br>5 To study basics of mathematics and science related to GNSS constellations | On completion of the course, students will be able to<br>1 Apply the knowledge of basic mathematics and science to understand the different GNSS constellations<br>2 Utilize different coordinate systems for accurate user position estimation.<br>3 Identify and categorize the sources of errors in GPS-based navigation systems.<br>4 Interpret and analyze GPS data for diverse real-time applications.<br>5 Apply knowledge of augmentation techniques to assess their suitability in specific GNSS-based applications. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | | 3 | | | | | | 2 | | 3 | |
| CO2 | 3 | 2 | | | | 3 | | | | | | 2 | | 3 | |
| CO3 | 3 | 2 | | | | 3 | 3 | | | | | 2 | | 3 | |
| CO4 | 3 | 2 | | | | 3 | | | | | | 2 | | 3 | |
| CO5 | 3 | 2 | | | | 3 | | | | | | 2 | | 3 | |

**UNIT - I :**

**GPS Fundamentals:** GPS Applications , GPS Constellation, Principle of operation, GPS Orbits, Orbital mechanics and satellite position determination, Time references, Geometric Dilution of Precision: Geometrical dilution of Precision, Veritical dilution of precision, Position dilution of precision.

**UNIT - II :**

**Coordinate Systems and errors:** Geometry of ellipsoid, geodetic reference system. Geoid, Ellipsoid, Global and Regional datum, World

geodetic system- 84, Different coordinate systems, Various error sources in GPS: Satellite and receiver clock errors, Ephemeris error, Atmospheric errors, Receiver measurement noise and User Equivalent Range Error.

**UNIT - III :**

**GPS measurements:** GPS signal structure, C/A and P-codes, Code and carrier phase measurements, position estimation with pseudo range measurements, Spoofing and anti spoofing, GPS navigation and observation data formats.

**UNIT - IV :**

**GPS Augmentation systems**: Code-based and carrier based Differential GPS(DGPS) Techniques, DGPS errors, Wide area augmentation system-architecture, GAGAN, Local area augmentation system concept.

**UNIT - V :**

**GPS Modernization and other satellite navigation systems:** Future GPS satellites, New signals and their benefits, Hardware and Software improvements, GPS integration – GPS/Geo Information System, GPS/Inertial Navigation Systedm, GPS/pseudolite, GPS/cellular, GLONASS, Galileo System.

**Learning Resources:**


1 Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance," Ganga- Jamuna Press, 2/e, Massachusetts, 2010.
2 G.S.Rao, Global Navigation Satellite Systems, Tata Mc Graw-Hill, 2010.
3 Satheesh Gopi, "Global positioning system: Principles and Application", TMH, 2005.
4 B. Hofmann-Wellenhof, H. Lichtenegger, and J. Collins, "GPS Theory and Practice," Springer Verlog, 2008.
5 Bradford W. Parkinson and James J. Spilker, "Global Positioning System: Theory and Application," Vol. II, American Institution of Aeronautices and Astronautics Inc., Washington, 1996.
6 https://nptel.ac.in/syllabus/105107062/


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Coding Theory and Techniques

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE862EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| The course will enable the students:<br>1 To study encoding and decoding of a message using source codes for data storage.<br>2 To differentiate different types of errors for linear block codes for data transmission.<br>3 To study convolutional codes fo error control.<br>4 To understand different construction methods of LDPC codes.<br>5 To study Galois fields required for BCH and RS codes. | On completion of the course, students will be able to<br>1 Apply the probabilistic method to construct different types of source codes.<br>2 Identify different types of errors and to comprehend various linear block codes.<br>3 Construct convolution codes for error detection and correction.<br>4 Generate LDPC codes for encoding with different specifications<br>5 Construct Galois Fields and to apply them to generate BCH and RS codes |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | | | | | | | | 3 | |
| CO2 | 3 | 3 | 2 | | | | | | | | | | | 3 | 3 |
| CO3 | 3 | 2 | 3 | | | | | | | | | | | 3 | |
| CO4 | 3 | 2 | 3 | | | | | | | | | | | 3 | |
| CO5 | 3 | 2 | 3 | | | | | | | | | | | 3 | |

**UNIT - I:**

**Coding for Reliable Digital Transmission and Storage:** Source coding: Entropy encoding algorithms: Arithmetic coding and Golomb coding, Dictionary codes: Lempel-Ziv codes, Run Length Encoding.

**UNIT - II:**

**Linear Block codes:** Block Codes, Hamming codes, Repetition codes, Reed-Muller codes, the (24,12) Golay codes, Interleaved codes.

**UNIT - III:**

**Convolutional codes:** Encoding, Structural properties, State diagram, Code tree diagram, soft decision and hard decision decoding, Viterbi algorithm.

**UNIT - IV:**

**Low Density Parity Check codes:** Introduction, Properties, Graphical Representation of LDPC Codes: Tanner graphs, Types of constructions, Regular and Irregular LDPC codes, methods of constructing LDPC codes: Galleger's method, Alzebraic construction of H for regular codes, Random construction of H for irregular codes, Encoding and problems.

**UNIT - V:**

**BCH and RS codes:** Groups, Fields, Binary arithmetic, Construction of Galois Fields GF($2^m$), Basic properties of Galois Fields, Introduction to BCH and RS codes.

**Learning Resource:**


1. K. Deergha Rao, 'Channel Coding Techniques for Wireless Communications," Second Edition, Springer 2019
2. Shu Lin and Daniel J. Costello, Jr. "Error Control Coding," 2/e, Pearson, 2011.
3. K Sam Shanmugum, "Digital and Analod Communication Systems," Wiley,2010.
4. Simon Haykin, "Digital Communication," TMH, 2009.
5. https://nptel.ac.in/courses/117106031/


The break-up of CIE: Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Language Models and Applications

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE870EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce students to foundational concepts in Natural Language Processing (NLP), including text preprocessing, regular expressions, and language modeling.<br>2. To enable students to apply statistical and rule-based methods such as N-gram models and part-of-speech tagging for linguistic analysis.<br>3. To familiarize students with neural network-based NLP models, including RNNs, attention mechanisms, and encoder-decoder architectures.<br>4. To provide students with practical exposure to transformer-based architectures such as BERT and GPT, including concepts in transfer learning and fine-tuning.<br>5. To explore the capabilities and applications of Large Language Models (LLMs), and to develop skills in prompt engineering for effective interaction with these models. | On completion of the course, students will be able to<br>1. Apply N-gram models and part-of-speech tagging techniques for text analysis, and evaluate word similarity using vector semantics.<br>2. Implement neural network-based models including RNNs and Transformers for natural language tasks and generation.<br>3. Apply transfer learning via fine-tuning for downstream NLP tasks.<br>4. Demonstrate understanding of large language models (LLMs), their architecture, applications, and domain-specific adaptations.<br>5. Explore real-world applications of LLMs in NLP tasks and apply prompt engineering for improved model interactions. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | 3 | | | 3 |
| CO2 | 3 | 3 | | | | | | | | | | 3 | | | 3 |
| CO3 | 3 | 3 | | | | | | | | | | 3 | | | 3 |
| CO4 | 3 | 2 | | | | | | | | | | 3 | | | 3 |
| CO5 | 3 | 2 | | | 3 | 3 | | | | | | 3 | | | 3 |

**UNIT-I:**

Introduction: Introduction – NLP. Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, words, corpora, Text Normalization, Minimum Edit Distance. N-gram Language Models: N-Grams. Part-of-Speech Tagging: HMM Part-of-Speech Tagging. CKY parsing. Vector Semantics and embeddings: Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Word2vec.

**UNIT-II:**

Neural Networks and Neural language Models: Feed forward Neural Networks, Feed forward Networks for NLP Classification and language modeling.

RNNs: Recurrent Neural Networks, RNNs as language models, RNNs for other NLP tasks, Encoder-Decoder models with RNNs, Attention.

**UNIT-III:**

Transformers: Self Attention Networks - Transformers, Transformers as language models.

Fine-Tuning and Masked Language Models: Bidirectional Transformer Encoders (BERT), Training Bidirectional Encoders, Transfer Learning through Fine-Tuning.

**UNIT-IV:**

Overview of large language Models: What are Large language Models?, Definition of LLMs ,Key Characteristics of LLMs, How LLMs work, Popular LLMs,GPT-3 and ChatGPT, Domain Specific LLMs.

**UNIT-V:**

Applications of LLMs: Classical NLP tasks, Free-Text Generation, Information Retrieval/Neural Sematic Search. Introduction to Prompt Engineering, Working with Prompts across Models.

**Learning Resources:**


1. Daniel Jurafsky & James H. Martin, "Speech and Language Processing", 3rd edition, Pearson Education.
2. (https://web.stanford.edu/~jurafsky/slp3/RevisedJanuary,2023)
3. James Allan, Natural Language Understanding, 2nd edition(1995),Pearson Education
4. Sinan Ozdemir, Quick Start Guide to Large Language Models: Strategies and Best Practices for Using ChatGPT and Other LLMs (Addison-Wesley Data & Analytics Series),2023.
5. Charnaick,Eugene,StatisticalLanguageLearning,MITPress,1993
6. Christopher D. Manning, Hinrich Schutze, Foundations of Statistical Natural Language Processing, (1999),The MIT Press.
7. Tanveer Siddiqui, USTiwary, Natural Language Processing and IRetrieval, (2008), Oxford University Press.


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Adaptive Signal Processing

(Professional Elective-VI)
SYLLABUS FOR B.E. (ECE) VIII – SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE871EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1 To introduce some practical aspects of signal processing, and in particular adaptive systems<br>2 The basic principles of adaptation which cover various adaptive signal processing algorithms (e.g., the LMS algorithm, RLS algorithm)<br>3 To understand applications, such as adaptive noise cancellation, interference cancelling, system identification.<br>4 To Estimate the innovation process for Kalman filtering problem.<br>5 To understand vector Kalman filters for target tracking | On completion of the course, students will be able to<br>1 Design and apply optimal minimum mean square estimators and in particular linear estimators.<br>2 Implement and analyze Wiener filters and evaluate their performance.<br>3 Implement and apply LMS, RLS, and Kalman filters for given applications.<br>4 Estimate the innovation process for Kalman filtering problem.<br>5 Analyze vector Kalman filters for target tracking |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | | | 3 | | | | | 3 | 2 | | | 3 |
| CO2 | 2 | 3 | 2 | | | | | | | | 2 | 2 | | | 3 |
| CO3 | 2 | 3 | 3 | | | 3 | | | | | 2 | 2 | | | 3 |
| CO4 | 3 | 3 | 3 | | | | | | | | 3 | 2 | | | 3 |
| CO5 | 2 | 3 | 3 | | | | | | | 2 | 2 | 1 | | | 3 |

**UNIT - I :**

Approaches to the development of adaptive filter theory. Introduction to filtering, smoothing and prediction. Wiener filter theory, introduction; Error performance surface; Normal equation; Principle of orthogonality; Minimum mean squared error;

**UNIT - II :**

Gradient algorithms; Learning curves; LMS gradient algorithm; LMS stochastic gradient algorithms; convergence of LMS algorithms.

**UNIT - III :**

Applications of adaptive filter to adaptive noise cancelling, Echo cancellation in telephone circuits and adaptive beam forming

**UNIT - IV :**

Kalman Filter theory; Introduction; recursive minimum mean square estimation for scalar random variables; statement of the Kalman filtering problem: the innovations process; Estimation of state using the innovations process; Filtering examples

**UNIT - V :**

Vector Kalman filter formulation. Examples. Applications of Kalman filter to target tracking.

**Learning Resource:**


1 Simon Haykins, "Adaptive signal processing", PHI, 1986. 3rd EDITION
2 Sophoclas, J. Orphanidies, "Optimum signal processing an introduction", McMillan, 1985.
3 Bernard Widrow, "Adaptive signal processing", PHI,1986
4 Bozic. SM., Digital and kalman Filtering
5 https://nptel.ac.in/syllabus/117105026/


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Biomedical Signal Processing

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE872EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. To introduce the fundamentals of probability theory and random processes with biomedical signals applications.<br>2. To equip students with the fundamental tools that are used to describe, analyze and process biomedical signals.<br>3. To acquire the knowledge on fundamental principles in the analysis and design of filters, power spectral density estimation and non-stationary signal processing techniques with cardiological and neurological signals.<br>4. To develop competency in implementing data compression techniques for biomedical signals, particularly ECG, using both time-domain and transform-domain methods.<br>5. To enable students to apply adaptive filtering and pattern recognition techniques for advanced biomedical applications such as ECG and EEG signal interpretation, arrhythmia detection, and sleep stage classification. | On completion of the course, students will be able to<br>1 Apply the probability theory and random processes techniques in analyzing biological signals.<br>2 Determine to best class of compression techniques to use for a particular bio medical signal to compress.<br>3 Possess the basic mathematical, scientific and computational skills necessary to analyze and process cardiological signals as per the requirement.<br>4 Ability to formulate and solve basic problems in biomedical signal analysis.<br>5 Possess the basic mathematical, scientific and computational skills necessary to analyze and process neurological signals as per the requirement. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 2 | | | | | | | 3 | | | 3 |
| CO2 | 3 | 2 | | | 2 | | | | | | | 3 | | | 3 |
| CO3 | 3 | 2 | | 2 | 2 | 3 | | | | | | 3 | | | 3 |
| CO4 | 3 | 2 | | | 2 | | | | | | | 3 | | | 3 |
| CO5 | 3 | 2 | | | 2 | | 3 | | | | | 3 | | | 3 |

**UNIT – I**

**Discrete and continuous Random variables**: Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables.

Stationary random process, Ergodicity, Power spectral density and

autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

**UNIT – II**

**Data Compression Techniques:** Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantisation, DCT and the K L transform.

**UNIT – III**

**Cardiological Signal Processing**: Pre-processing. QRS Detection Methods. Rhythm analysis. Arrhythmia Detection Algorithms. Automated ECG Analysis. ECG Pattern Recognition. Heart rate variability analysis.
Adaptive Noise Cancelling: Principles of Adaptive Noise Cancelling. Adaptive Noise Cancelling with the LMS Adaptation Algorithm. Noise Cancelling Method to Enhance ECG Monitoring. Fetal ECG Monitoring.

**UNIT – IV**

**Signal Averaging, polishing** – mean and trend removal, Prony's method, Prony's Method based on the Least Squares Estimate, Linear prediction. Yule – walker (Y –W) equations, Analysis of Evoked Potentials.

**UNIT-V**

**Neurological Signal Processing**: Modelling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modelling of seizure EEG. Sleep Stage analysis. Inverse Filtering. Least squares and polynomial modelling.

**Learning Resources:**


1. Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, 4th ed., 2009, TMH.
2. Biomedical Signal Processing- Principles and Techniques – D.C.Reddy, 2005, TMH.
3. Digital Bio signal Processing – Weitkunat R, 1991, Elsevier.
4. Biomedical Signal Processing – Akay M, IEEE Press.
5. Biomedical Signal Processing –Vol. I Time & Frequency Analysis – Cohen.A, 1986, CRC Press.
6. Biomedical digital Signal Processing: C-Language Experiments and Laboratory Experiments, Willis J.Tompkins, PHI.
7. https://nptel.ac.in/courses/108105101/ Biomedical Signal Processing – by Prof.Sudipta Mukhopadhyay. IITKGP
8. http://www.ecdept.iitkgp.ac.in/index.php/home/faculty/smukho


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Blockchain Technology and Applications

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE880EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Introduce the foundational concepts and evolution of Blockchain technology, types, architecture, and decentralization.<br>2. Explain the operational principles of cryptocurrencies, particularly Bitcoin and its underlying components such as transactions, mining, and keys.<br>3. Explore consensus mechanisms like Proof of Work (PoW), Proof of Stake (PoS), and other alternatives, along with scripting and functional challenges.<br>4. Examine major blockchain platforms like Ethereum, Hyperledger, and IOTA, and the design of decentralized applications.<br>5. Analyze privacy, security issues, and AI integration in Blockchain with relevant case studies across sectors like healthcare, finance, and retail. | On completion of the course, students will be able to<br>1. Illustrate the key principles, types, and benefits of Blockchain technology, including decentralization and cryptographic fundamentals.<br>2. Apply knowledge of Bitcoin operations, including digital keys, transactions, mining, and analyse its limitations and alternatives.<br>3. Compare and evaluate consensus protocols like PoW, PoS, and understand scripting features in Bitcoin networks.<br>4. Differentiate between blockchain platforms and design simple decentralized applications for real-world scenarios.<br>5. Assess privacy, security issues, and AI-driven applications in blockchain through use cases in healthcare, finance, and supply chain. |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | 3 | | 3 | |
| CO2 | 3 | 2 | | | | | | | | | | 3 | | 3 | |
| CO3 | 3 | 2 | | | | | | | | | | 3 | | 3 | |
| CO4 | 3 | 2 | | | | 3 | | | | | | 3 | | 3 | |
| CO5 | 3 | 2 | | | | | | | | | | 3 | | 3 | |

**UNIT-I:**

**Introduction:** Introduction to Blockchain, Properties of blockchain technology, Distributed systems, History of blockchain and Bitcoin, Types of blockchain. Hash functions.

Decentralization: Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized organizations and platforms for decentralization.

**UNIT-II:**

**Blockchain: Architecture**, Versions, Variants, Use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.

Bitcoins: Introducing Bitcoin, Bitcoin digital keys and addresses, Transactions, Blockchain mining. Alternative Coins. Limitations of Bitcoin.

**UNIT-III:**

**Bitcoin basics:** Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use

**UNIT-IV:**

**Introduction to Blockchain Platforms**: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, etc. Advantages and Disadvantages, Ethereum vs Bitcoin, Design a new blockchain, Potential for disruption, Design a distributed application, Blockchain applications.

**UNIT-V:**

**Privacy, Security issues in Blockchain**: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains, Block chain case studies in Retail ,Banking and Financial services, Health care, Energy and utilities Integration of AI and blockchain for secure electronic health records, medical diagnostics, and drug traceability.AI-driven customer analytics, fraud detection, and supply chain optimization in retail using blockchain-based transparency and authenticatio

**Learning Resources:**

1. Mastering Block chain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017 Reference Books.
2. Imran Bashir, "Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing.
3. Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan" "Blockchain Technology" ISBN: 9789389211634 | Year: 2020.
4. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
5. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design And Use Cases"[MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184

The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests : 2 | | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments : 3 | | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes : 3 | | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

# Network Management

(Professional Elective-IV)
SYLLABUS FOR B.E. (ECE) VIII - SEMESTER

| | | |
|---|---|---|
| L:T:P (Hrs./week) : 3:0:0 | SEE Marks : 60 | Course Code: **U22PE881EC** |
| Credits : 3 | CIE Marks : 40 | Duration of SEE : 3 Hours |

| COURSE OBJECTIVES | COURSE OUTCOMES |
|---|---|
| 1. Analyze the goals, organization, functions, and architecture of network management and the network topologies and transmission technologies.<br>2. Understand and evaluate various network management standards network monitoring.<br>3. Examine and implement TMN standards, architecture, and management service frameworks solutions.<br>4. Apply and analyze key network management functions, including configuration, fault, performance, security.<br>5. Configure and manage LAN access, SNMP and IP-based services using tools such as web browsers | On completion of the course, students will be able to<br>1. Explain network management perspectives<br>2. Apply various network management protocol<br>3. Identify and describe TMN standards<br>4. Analyze various management issues<br>5. Demonstrate how to correctly maintain LAN |

**CO-PO/PSO Mapping**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO2 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO3 | 3 | 2 | | | | | | | | | | | | 3 | |
| CO4 | 3 | 2 | | 3 | | | | | | | | | | 3 | |
| CO5 | 3 | 2 | | | | | | | | | | | | 3 | |

**UNIT - I:**

Overview of Data Communication and Network Management – Goals, Organization and Functions; Network Management – Architecture and Organization; Network Management Perpestives; Current Status and Future of Network Management. Network Topology, Network Node Components, Transmission Technology.

**UNIT - II:**

Network Management Standards, Network Management Models, Organizational Model, Information Model, Communication Model. **SNMPv1 –**History of SNMP, Internet Organization and Standards, SNMP Model, Organizational Model, System Overview, Information Model. SNMP Communication Model, Functional Model.SNMPv2 and SNMv3.

**UNIT - III:**

TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, TMN Integrated View, TMN Implementation.

**UNIT - IV:**

Configuration Management, Fault Management, Performance Management, Security Management, Service Level Management, Accounting Management, Report Management, Policy-Based Management.

**UNIT - V:**

Setting-UP LAN Access, SNMP configuration, Switched Port Analyzer, Web Browser / Web Server Communication. IP Network Management - Configuration, Management Information Base, Simple Network Management Protocol, IP-Based Service Implementation- Network Management Issues, OSS Architecture.

**Learning Resources:**


1. Mani Subramanian "Network Management - Principles and Practice", Addison-Wesley, 2000.
2. Salah Aiidarons, Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998.
3. Lakshmi. G, Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi
4. J. Richard Burke, "Network Management: Concepts and Practice, A Hands-on Approach", Pearson Education, 2008.


The break-up of CIE : Internal Tests + Assignments + Quizzes

| | | | | | |
|---|---|---|---|---|---|
| 1. | No. of Internal Tests | : 2 | Max. Marks for each Internal Test | : | 30 |
| 2. | No. of Assignments | : 3 | Max. Marks for each Assignment | : | 5 |
| 3. | No. of Quizzes | : 3 | Max. Marks for each Quiz Test | : | 5 |

Duration of Internal Tests: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
ACCREDITED BY NAAC WITH 'A++' GRADE
IBRAHIMBAGH, HYDERABAD – 500 031

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Activity Planner / Calendar for the Academic Year 2025-26

| S.No. | Date | Activities planned |
|---|---|---|
| 1 | 02-08-2025 | Introduction and objectives of CCA activities, Introduction of Techniche Proposal which mainly focuses on the development of technical skills in students through projects, workshops and technical talks in various domains. |
| 2 | 23-08-2025 | Guest lecture on Recent trends in industrial growth, Rohit Lingala, 2022, application developer II, Oracle (AI Agents) |
| 3 | 30-08-2025 | Awareness on Library learning Resources, by Mr. Ravi Kumar Librarian, VCE |
| 4 | 06-09-2025 | Extempore Contest for BE ECE (A, B & C) Sem-5 students) in association with IETE Students' Forum. |
| 5 | 20-09-2025 | Guest lecture on career guidance by Vinay garu, Dir SRE, Optum |
| 6 | 27-09-2025 | Poster Presentation on "IoT Solutions in Agriculture" for BE (ECE) Sem-3, Sem-5 and Sem-7 students in association with IETE Students' Forum (ISF) |
| 7 | 18-10-2025 | Invited talk by Professor C. Vanitha NIT-Warangal |
| 8 | 25-10-2025 | "Logical Wizard", A technical event conducted for 5$^{th}$ semester students of ECE (A, B & C) in association with IEEE SB VCE Unit. |
| 9 | 01-11-2025 | Guest lecture on skills need for career growth Manoj Kumar Infrastructure Engineer principal global services. |
| 10 | 15-11-2025 | Technical Essay Writing Competition for BE ECE (A, B & C) Sem-1 students on "Technology in Professional Ethics– need of the hour" in association with IETE Students' Forum (ISF) |
| 11 | 22-11-2025 | Technical Talk on "Introduction to FPGA" by Mr. Vamshi, Member of Technical staff, AMD, Hyderabad |

| S.No. | Date | Activities planned |
|---|---|---|
| 12 | 03-01-2026 | Guest Lecture on Internet of Things: From idea to prototyping Dr. Shyam Sunder Associate Professor, ECE, Osmania University |
| 13 | 17-01-2026 | Invited talk on contributions of DRDL for nation building – Prof. Arun Kumar, VCE, Hyderabad. |
| 14 | 24-01-2026 | Invited talk on Recent trends in industrial growth by Dr. K. Krishna Kishore Director AI-Powered Business Expansion, Houses of Companies- T-hub, Hyderabad. |
| 15 | 31-01-2026 | Invited talk on Artificial Intelligence and its impact on the world by – Mr. Karthik, Head – AI division, SignalLyaer, Hyderabad |
| 16 | 07-02-2026 | Technical talk by T. Pavan Kalyan Analog Design Engineer in MOSCHIP Technologies |
| 17 | 21-02-2026 | Hackerrank™ based coding contest "Hackathon 2026" for BE ECE Sem-1 students in association with IEEE SB. |
| 18 | 28-02-2026 | A Workshop on "Robotryst (Programming nodeMCU)" |
| 19 | 07-03-2026 | "Tech Lipi – A technical contest" for BE ECE (A, B & C) (Sem – 4) students in association with IETE Students' Forum |
| 20 | 21-03-2026 | Career guidance by V. Satya Sri Engineer at QUALCOMM, Hyderabad, Telangana, |
| 21 | 28-03-2026 | Guest Lecture on "Electronic Instrumentation and Various Test procedures" Mrs. Phani Madhuri, Deputy Manager, BEL, Hyderabad |
| 22 | 04-04-2026 | "Hardware circuit design Contest" in association with IEEE SB of VCE Unit. |
| 23 | 18-04-2026 | Guest lecture by Mr. Neeraj, Alumni VCE. |
| 24 | 25-04-2026 | Guest Lecture on "Importance of life skills for securing jobs", by Durga prasad Yaragunta, Trainer in sift skills and life skills, Editor in chief, Insight Publications pvt ltd Hyderabad |